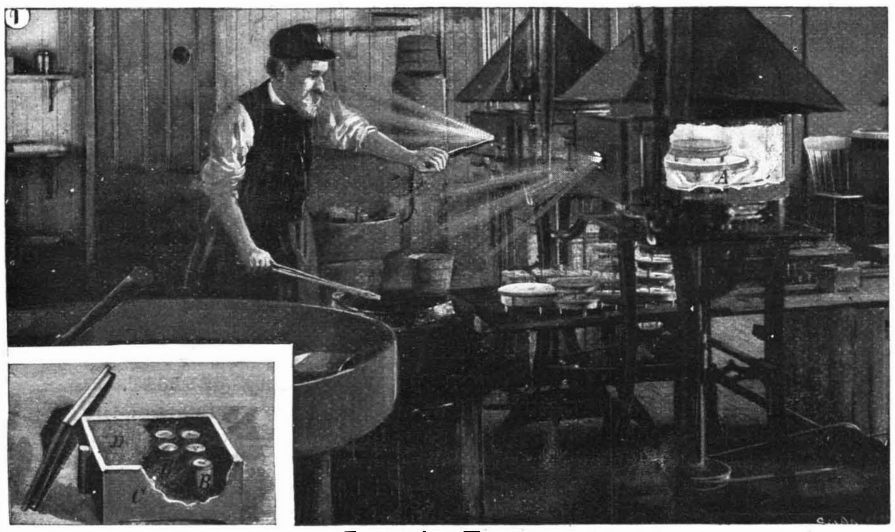
SCIENTIFIC AMERICAN

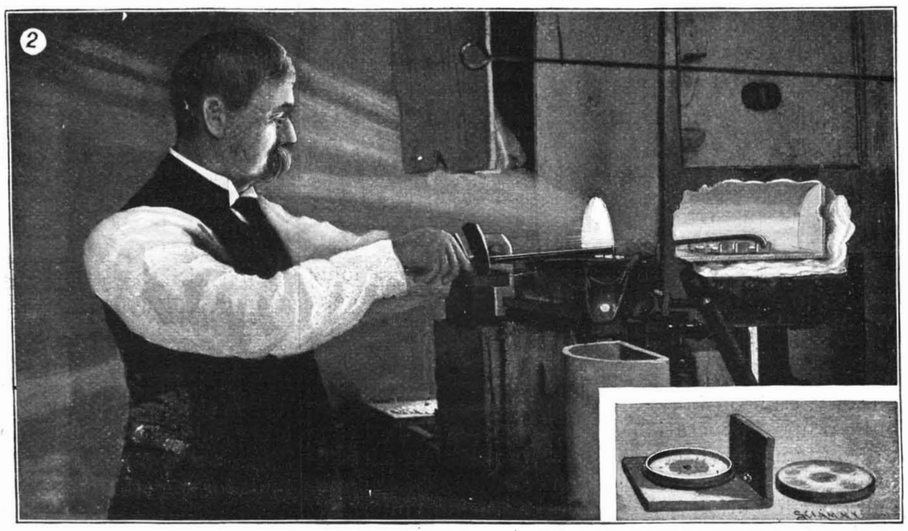
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1899, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

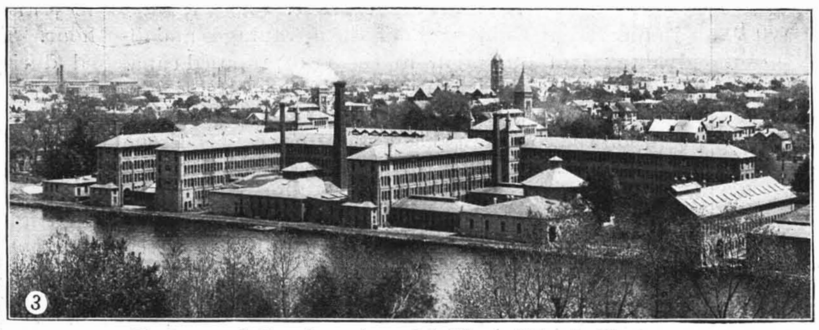
Vol. LXXX.—No. 9. ESTABLISHED 1845. | NEW YORK, MARCH 4, 1899. | [$3.00 A YEAR. WEEKLY.



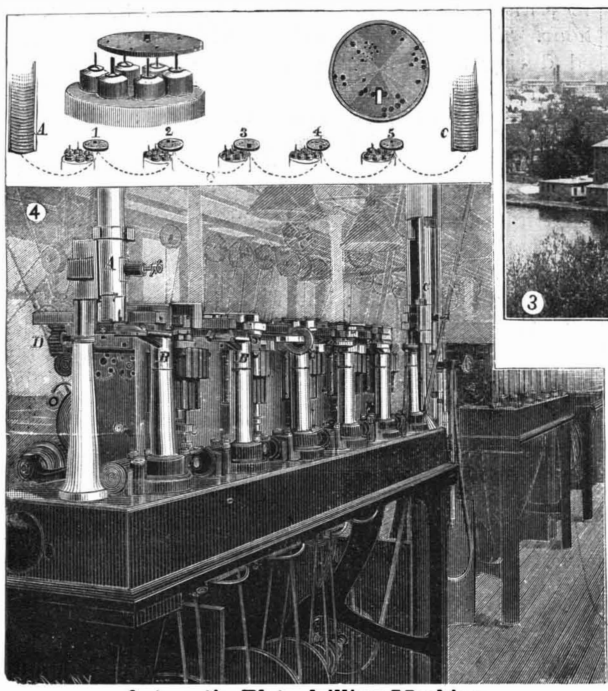
Tempering Furnace.



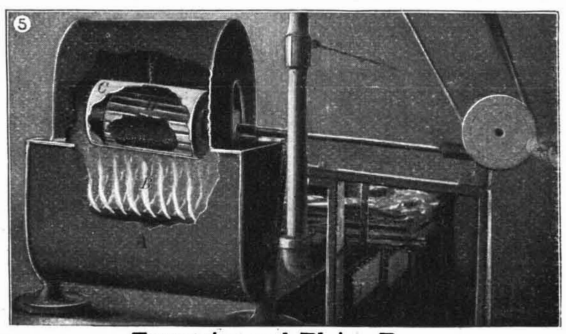
Balance Melting Furnace.



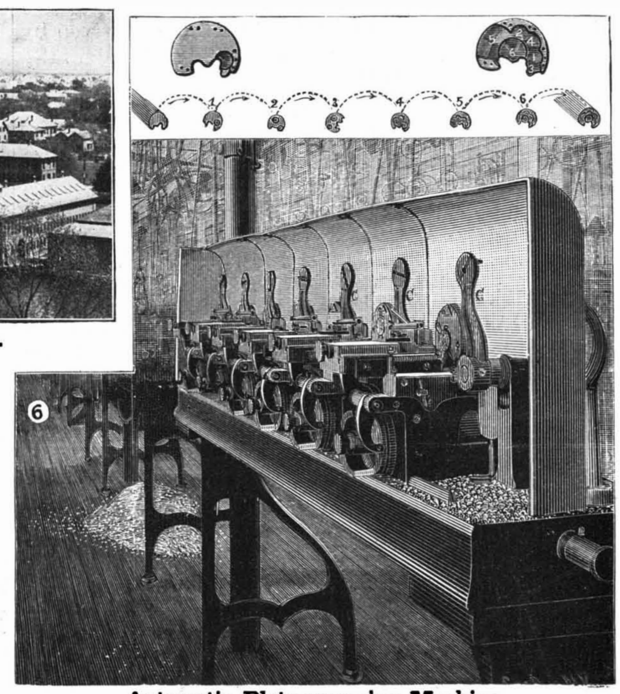
Factory of the American Waltham Watch Company.



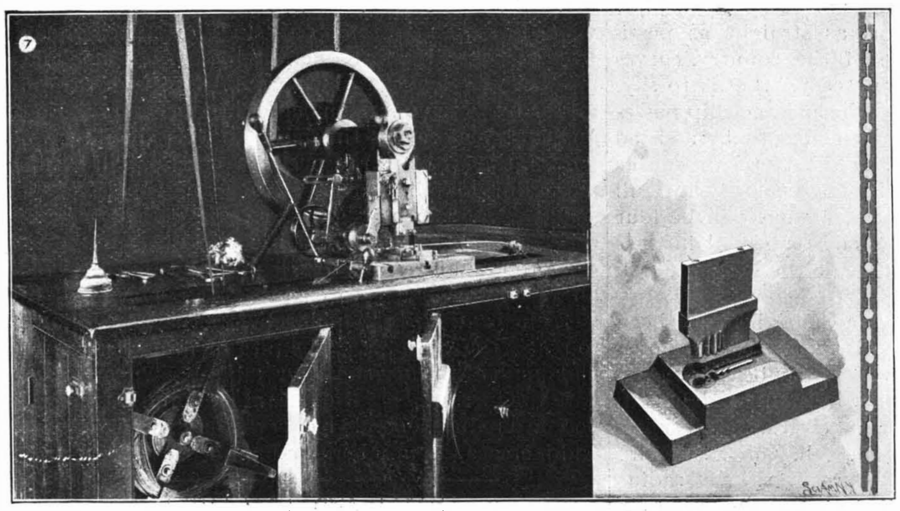
Automatic Plate-drilling Machine.



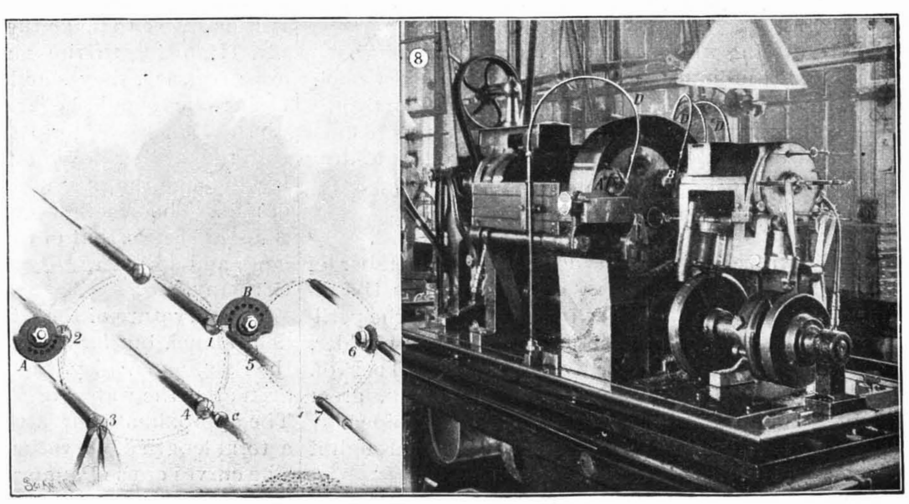
Tempering and Bluing Drum.



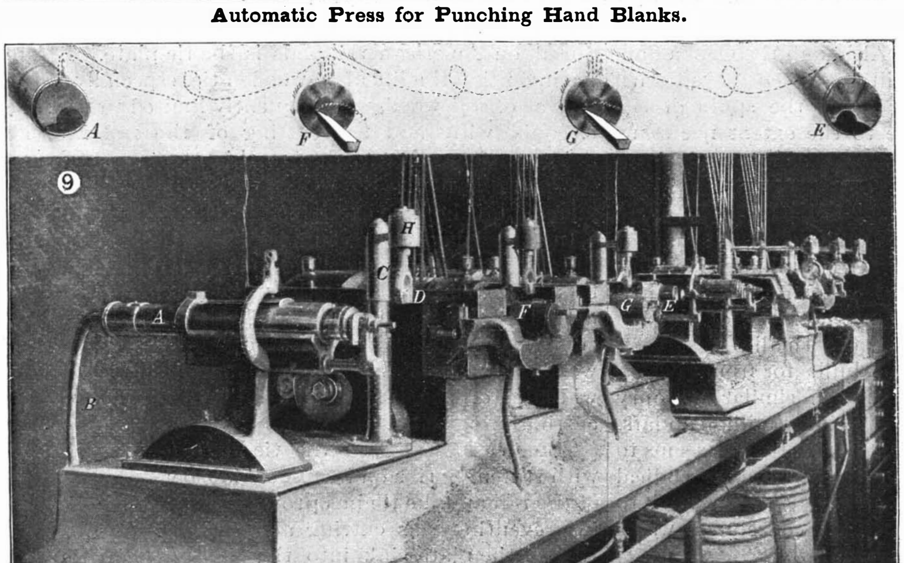
Automatic Plate-recessing Machine.



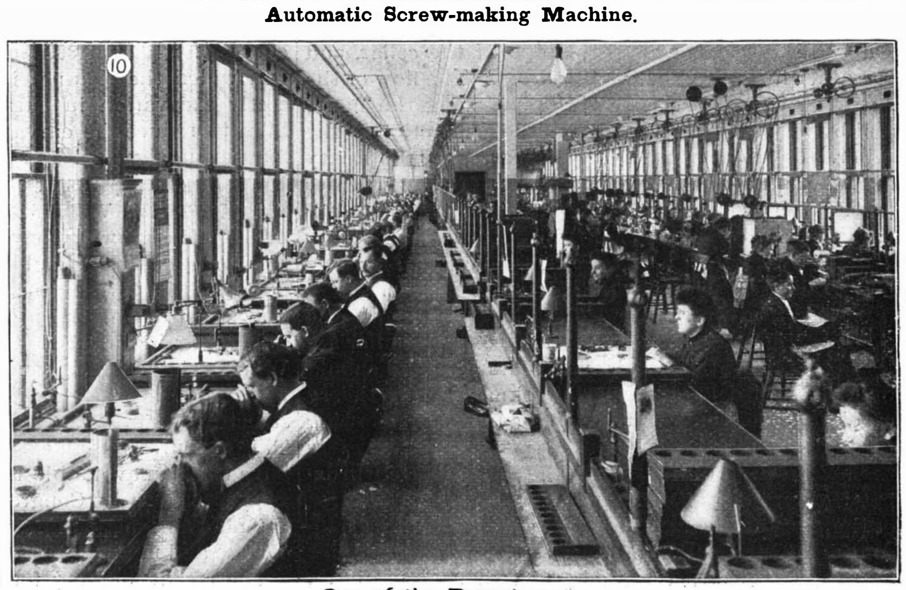
Automatic Press for Punching Hand Blanks.



Automatic Screw-making Machine.



Automatic Plate-facing Machine.



One of the Departments.

THE BUILDING OF A WATCH.—[See page 132.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico......... $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)	$3.00	a year.
Scientific American Supplement (Established 1876)	5.00	"
Scientific American Building Edition (Established 1885)	2.50	"
Scientific American Export Edition (Established 1878)	3.00	"

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MARCH 4, 1899.

AIR BUBBLES.

It is greatly to be regretted that the inception of such a great industry as that of the automobile carriage in this country should be hampered by the sensational methods adopted by some of its so-called promoters. We refer to the omnipresent Autotruck Company, which, under the magic spell of certain names notorious in the more spicy periods of the political history of our city, still continues to enlarge on paper the sphere of its proposed operations. We have scarcely had time to grow familiar with the Air Power and Autotruck companies, with their capitalization of $10,000,000 or more, and their intention to "control the trucking interests" of the city, before we are told that "Richard Croker is about to cross swords with the Third Avenue Railroad Company by fitting out a line of omnibuses driven by compressed air," etc. It is also added incidentally that "the Autotruck Company proposes to run stages similar to those proposed for Fifth Avenue, in Chicago and in Los Angeles, Cal.," yet we doubt if anyone has yet seen a street autotruck, and even the company cannot say more than that "orders for the construction of these vehicles have been given."

LIMITATIONS OF THE AUTOTRUCK.

We think it is extremely unlikely that the autotruck, if it should ever get beyond the precincts of Wall Street, will succeed in displacing entirely the horse-drawn truck. For certain conditions of our city trucking it would be an immediate and absolute failure; as for instance, in a snowstorm like the last, in which Mr. Croker's autotrucks would be even more helpless than Mr. Vreeland's trolley cars have proved to be.

The weak spot in the autotruck would lie in the fact that the measure of its tractive force would be determined by the adhesion of the driving wheels, and in the greasy condition of the streets on which heavy hauling is done, the adhesion would be very small indeed. If a 5-ton autotruck attempted to cross the well lubricated paving of West Street or Water Street with a full load, not all the $10,000,000 of vaporous capital of the air company, if put into the motors, could budge it an inch.

If the driving wheels should chance to drop into one of the multitudinous holes with which the Metropolitan Street Traction Company, having got in its wires, has strewn our thoroughfares, it would stay there until the discarded horse could be brought around to drag its discredited competitor from the pit.

ELECTRICITY AS A THAWING AGENT.

If the statistics were gathered of the number of houses that are burned down every winter, as the result of attempts to thaw out frozen pipes by the perilous methods ordinarily practiced by the householder, the results would be decidedly sensational. To Prof. R. W. Wood, of the University of Wisconsin, great credit is due for showing that a frozen water pipe may be thawed out by the expedient of running through it an electric current of the proper strength.

In the present case a stretch of 300 feet of pipe between a house and the street main was solidly frozen. One wire was attached to the pipe in the cellar, and the other to a faucet across the street. The flow of the current was down the service pipe, along the main, and by way of the frozen pipe to the connection in the cellar. It was only necessary to heat the pipe to sixty degrees, and it is stated that within twenty minutes there was a full head of water in the cellar. The apparatus employed was planned by Prof. Jackson, and is being used with great success, two houses at a time being relieved thereby from their water famine.

It is evident that while electric thawing avoids the obvious risks of thawing out by hot coals or similar applications of heat, it has dangers of its own, and should only be applied by an expert workman. The theory of electric thawing is that the current in flowing through the metal meets with a resistance which raises the temperature of the pipe. The temperature will depend, other things being equal, upon the sectional area of the pipe, and care should be taken that there is no considerable reduction of the size of pipe at any point between the electric terminals, since there would be an immediate overheating due to the reduced area which would be a source of danger. The current used would not have to be as large as might be supposed, the coefficient of electrical resistance being, for instance, twelve times as great for lead as for copper. With proper precautions the process is not dangerous, and the saving in the way of excavation and plumbing will be very considerable.

COST OF THE BOSTON SUBWAY.

The figures of the cost of the Boston Subway, as given in the fourth annual report of the Boston Transit Commission, are very gratifying to the friends of the proposed rapid transit tunnel in New York. It was estimated in 1894, before work was begun, that the cost of the subway would be $5,000,000. Now that the work is completed, a close estimate places the total cost at $4,250,000, exclusive of the cost of certain alterations called for by legislation in 1897. It is not often that engineering works cost less than the estimate, and we do not call to mind any case where works of this magnitude have not somewhat exceeded the estimate.

There are no special difficulties or uncertainties connected with the construction of the New York underground scheme which afford reason to expect that it would cost more than the estimates. The work would all be of a kind with which engineers are familiar, and, indeed, if the funds for construction were furnished as fast as the engineers could use them, and a big force of labor were engaged simultaneously along the whole route, we think it is likely that the tunnel could be built for something less than the estimate of $30,000,000.

COMPARATIVE MERITS OF THE PANAMA AND NICARAGUA CANALS.

In our recent comparison of the advantages and disadvantages of operation in the two proposed canals across the isthmus, we omitted to draw attention to one or two features which would have more or less effect upon the commercial success of the canals, should both be built. We refer to the question of favorable winds as affecting the amount of sailing tonnage that would seek either route, and to the yet more serious question of the curvature of the canals as affecting both steam and sailing vessels. It is in favor of Nicaragua that for ten months of the year there are steady trade winds, which would enable sailing ships to reach either terminus without the assistance of tugs except in entering the artificial harbors. In the latitude of Panama, on the other hand, there are long periods of calm which might render somewhat lengthy towing necessary. While the objection counts for something, it is not so serious as might be supposed, for the reason that the deep sea sailing tonnage forms a very small and rapidly diminishing proportion of the total tonnage. In fact, it is probable that by the time either canal is finished, the tramp steamer will have completely ousted the sailing ship from the long distance carrying trade.

In laying out a ship canal, the curvature is one of the most important questions for consideration. In view of the ever-increasing length of ocean steamships, it is desirable to make the canal as straight as possible. If, owing to the nature of the country, curves are necessary, they should be "easy," that is to say, their radius should be large. When a large ship passes up the Manchester Ship Canal, she has to be assisted by a tug at her head and one at the stern to enable her to make the turns. This is tedious, costly and full of risk. The smallest curve at Panama will be four times as easy as that of the Manchester Canal in England, and double as easy as those of the Kiel Canal in Germany.

The curvature of the Nicaragua Canal has not been determined, but for about 50 miles of its course down the San Juan Valley it must necessarily be very sharp, even after the waters of the river have been dammed. The approximate curvature of the river channel shows a total length of curvature in the valley of 39·6 miles. The curves of the Panama Canal are of 8,200 feet radius or over, while the river channel at Nicaragua has six curves of 700 to 1,500 feet, 15 of 1,500 to 2,500, and 21 curves of 2,500 to 3,000 feet. Although the Ochoa dam will widen the channel, it will be difficult, even with costly excavation in cutting away the spurs of the hills, to reduce the curvature to the extent necessary for easy navigation.

MASONRY VERSUS WOODEN DRY DOCKS.

There is a growing conviction among naval men that the United States should cease to build wooden dry docks and in future construct all of its docks of masonry. The principal argument in favor of wooden structures is, or used to be, the smaller first cost. While a timber dock could be built for from $400,000 to $600,000 according to its size, a similar masonry structure used to cost from two to three million dollars. This of course was an extravagant figure, but seems to have been unavoidable under the plan of periodical appropriations by Congress, which caused the work to extend over long periods with much consequent waste of time and money.

The recent bidding for a stone drydock at Boston brought out the welcome fact that a masonry structure can be built for a moderate increase of cost over one of timber. The cost of the dock will be about $1,000,000 whereas the timber dry dock (known as No. 3) at the Brooklyn navy yard cost between $600,000 and $700,000, and in the two years of its existence it has cost for repairs $171,000.

Prof. W. L. Cathcart, of Columbia University, in a paper on the subject read before the American Society of Civil Engineers, gives some significant figures regarding the cost of repairs on the two types of docks, in which it is shown that the least average annual expenditure for repairs and maintenance was $230 per year for the stone dock at Mare Island, while the highest expenditure was that upon the Brooklyn navy yard wooden dock, above mentioned, which averaged $85,500 per year. A comparison of three stone docks, those at Boston, Norfolk, and Mare Island, shows an average yearly expenditure of $1,558, while the average on four timber docks at New York, League Island, Norfolk, and Port Royal, was $13,364. Commodore Endicott, Chief of the Bureau of Yards and Docks, stated that a timber dock has to be practically rebuilt in from twenty to twenty-five years, the experience of the navy all tending to prove that the masonry dock is superior in practically every respect.

THE FASTEST VESSEL AFLOAT.

Until the new and large torpedo boats of the "Turbinia" type, now building at Newcastle, England, have been completed, the credit of having turned out the fastest vessel will belong to a German yard. The "Hai Lung," built by Schichau, of Elbing, for the Chinese navy, is credited with having made a run of 18½ knots at an average speed of over 35 knots an hour. The builder states that the highest speed realized during the run was 36·7 knots or 42·26 miles per hour. The best run of the "Turbinia" for a mile is 35 knots, so that the Schichau vessel has a substantial lead.

The most remarkable feature of this boat next to her speed is the fact that she is fitted with reciprocating engines. At the time the "Turbinia" made her phenomenal speed, it was popularly supposed that it was entirely due to her new form of motor. In great part no doubt it was; but there is reason to believe that the excellent steam-raising qualities of her boiler contributed in no little degree to the result. Relatively considered, the performance of the "Turbinia" was more meritorious, for the reason that she is only a 40 ton craft, while the Schichau boat is of 180 tons displacement, or four and one-half times larger. The new and enlarged "Turbinias" will be full sized torpedo boats, and for this reason it is likely that they will surpass the "Hai Lung" by a considerable margin of speed. Just what the excess will be is a matter which is exciting much speculation in naval quarters.

FLASHLESS RAPID-FIRE GUNS.

It is reported that the new French rapid-fire gun invented by Colonel Humbert gives no flash or sign of fire. If this be true, the French have made an advance in artillery second only in importance to that which marked the introduction by them of smokeless powder. In the operations around Santiago, the only means by which our men could locate the position of an enemy's piece was the flash. If this should be removed, the art of war, especially on land, will become more difficult than ever, for a masked battery of smokeless and flashless guns would be positively undiscoverable. The only description of the gun that has come to hand is rather obscure; but it would seem that an attempt is made to cool the larger portion of the gases below their flash point before they are allowed to reach the open air. The rate of fire has reached a maximum of twenty shots per minute. To accommodate the increased expenditure of ammunition it is proposed to reduce a single battery from five to four guns and increase the number of ammunition wagons.

RAILS AND TIE-PLATES.

One of the most useful improvements ever introduced on American railroads is the tie-plate. Before its invention the life of a wooden tie, especially if the tie was of soft wood, was frequently limited to the time it could withstand the cutting of the rail into its upper surface. Wear, due to this cause, was always considerable, and as the weight and frequency of trains increased, it became excessive.

In earlier days it was supposed that the material of the tie gave way by crushing; but of late years it has been believed that it is the wave-like movement, set up in the elastic rail by the wheels of the cars, that acts with an abrading effect upon the fibers of the wood. If this is the true explanation, no amount of widening of the base of the rail will prevent it from cutting into the tie.

The interposition of the tie-plate (a square plate with stiffening ribs on its under side) between the base of the rail and the tie has proved wonderfully effective in preventing this cutting action. The longitudinal ribs of the plate sink into the tie, and keep tie and plate in a fixed relative position; the rail spikes

pass through holes punched in the tie-plate, and are thus held at all times snugly against the rail. Mr. Sandberg, whose good work in past years in advocating the use of rails of greater weight and stiffness is universally appreciated, does not appear to understand the true function of the tie-plate as explained above; for he has lately made a plea for the widening of the base or flange of the rail as a means of preventing cutting of the ties. The only possible gain if this were done would be an increased stability against overturning of the rail (which, by the way, is not called for, overturning being a very rare occurrence), and a broader bearing on the ties, which, as we have seen, would not go very far toward preventing their destruction. Moreover, to widen the base throughout the whole length of the rail would be extravagant, for the reason that the present base has ample cross-section considered as the bottom chord of a girder to carry the load concentrated between adjoining ties.

SUGGESTIONS CONCERNING TRADE WITH RUSSIA.

Russia occupies an area of 8,500,000 square miles, a sixth of all the land of the globe, and it has a population of 130,000,000 souls. There are 140 different races and 90,000,000 of the inhabitants are farmers. This country, certainly, constitutes a world large enough to command the attention of the leading manufacturers and exporters of the United States who are seeking a market for their surplus.

There is a general desire on the part of Russian merchants and dealers to establish relations with American manufacturers, provided that it can be done advantageously to themselves; but, as a rule, however, American houses have a general agent in England or Germany, who supervises all the business for Europe and appoints sub-agents in Russia, who naturally receive but a small fraction of the commission. Russian agents naturally object to dealing through an agent in London or Hamburg, and would much rather deal directly with the home company. One of our great locomotive works and a great pump works, some years since, gave the exclusive agency for their goods in Russia to St. Petersburg agents, who deal directly with the home company, and practically control the Russian market for locomotives and steam pumps, their trade amounting to millions every year, while agents for rival companies are unable to compete with them. What has been accomplished by these companies can be done by others with equally meritorious articles. English firms give a credit of from nine to twelve months, the buyer usually accepting a draft, payable at a London bank, without interest. Longer credits and open accounts are also common. American exporters usually require payment at an American bank, on the presentation of bills of lading showing that the freight had been delivered on board the steamer at some seaport. This is well enough for such cash articles as cotton, resin, etc., but, where there is sharp competition in manufactured articles, the terms offered by other countries must be made to secure business.

The American consuls in Russia are in constant receipt of letters and circulars from American manufacturers and export associations, making inquiries as to the prospect and methods of introducing their goods, but purchasers naturally desire to see and examine any article they desire to purchase, and, therefore, the circulars printed in English, which few merchants can read, are of little use. Russians have respect and admiration for the inventive genius of the Americans, and while conservative, they are always willing and anxious to look into new inventions from the United States; but those who desire to do business in Russia should prepare special matter and have the same printed in either German or Russian, preferably Russian. They should state the price of the articles offered for sale at the lowest terms of discount, terms of payment in Russian values and weights, and cost delivered on board of vessel at a prominent seaport. The surest and best plan to introduce goods into Russia is to send samples by a thoroughly competent representative of the business. It is not absolutely necessary for him to have a knowledge of the Russian language, as interpreters can be found in all the leading cities of Russia, yet an acquaintance with Russian, German, or French would be of great assistance. Articles of manufacture, with the exception of portable and traction engines, thrashing machines and plows made in the United States, are preferred to those manufactured elsewhere. American thrashers and engines are too light to stand the rough usage to which such machines are subjected in Russia. There is a large and increasing trade in American harvesting machinery and farming implements, such as binders, mowers, reapers, hay rakes, etc. The only plows used in European Russia are those manufactured in Russia and Germany, which are cheap and give good satisfaction. The Germans are constantly studying the Russian market, and manufacture articles in the style and manner they find specially adapted to the wants of the Russian farmers.

Notwithstanding the rapid progress Russia is making in the establishment of manufactories, which are being encouraged by the government, she is not able to keep pace with the increased demand for iron, locomotives, cars, coast steamers, battleships, elevators, electrical apparatus and supplies, wood working machinery, tin plate, agricultural implements, resin, cotton, roofing slate, leather, scales, heavy ordnance, typewriters, tools, bicycles, sewing machines, hardware, coal and other machinery, photographic materials, as well as in other lines in which our supremacy is unquestioned. Russia offers such a rich field for investment and profitable trade that our manufacturers should study the market and methods of doing business. The Russian railway and manufacturing systems are now in their infancy, and there will be for years a constant demand for car material, railroad machinery, etc.

As in other export trade, it is the buyer, and not the seller, who determines the kind of articles he wants and the form in which he wants them turned out, labeled, and packed for shipment. It is the business of the seller to ascertain what the buyer wishes and offer him a better article for the same or less money than he has been paying.

The recent order removing the duty on almost every article used in agriculture will make such a reduction in their price as to place them within the reach of many farmers who have been unable to purchase them until now, and must largely increase their sale. There is a fine field for fire extinguishing apparatus, hose, electric cars, passenger and freight elevators, improved flour mills, planing mills, coal and other mining machinery. It is proposed by Ambassador Hitchcock, if possible, to hold an American exposition in 1901, immediately following the Paris exposition, as the best means of introducing and advertising goods, and offering American manufacturers an opportunity to become acquainted with Russian merchants and to acquaint themselves with the kind of goods adapted to the market, and the methods of doing business. By a recent convention the International Money Order system between the United States and Russia went into effect on the first day of January, 1899.

The above is an abstract of the interesting Consular Report of W. R. Holloway, our Consul-General at St. Petersburg.

THE COMSTOCK MINES AND THEIR DRAINAGE.

A systematic and determined attempt is to be made to lower the water level in the great Comstock mines, and permit a resumption of extracting ores down to the 2,100 foot level. By a combination of the directors of the thirty, or more, mines interested, $100,000 has been raised for this purpose. At present, these mines are flooded 40 feet below the outlet of the Sutro tunnel, which is 1,663 feet below the opening of the shaft of the Savage mine. The purpose is first, to exhaust the upper level of 500 feet of water and then, if the plan pursued is successful, the remaining levels, extending as far down as 3,300 feet, in the deepest shaft, will be ultimately drained, and the stocks of ore, known to exist in the submerged territory, will be brought to light. No estimate of the quantity of water that will have to be withdrawn, in order to dry out the various mines, has been computed, but that it is enormous is well known. The magnitude of the task is fully realized by those who have the matter in charge. In 1877, the half dozen pumps of the Hale and Norcross mines raised, in six months, no less than 400,000 tons of water at a cost of one cent for every 20 gallons raised; 1,800,000 tons were pumped out in 30 months. The experience of every deep mine on the Comstock lode is identical.

The cessation of pumping caused the immediate flooding of the shafts. Some conception of the enormous task undertaken can be discerned from these facts. The cost of raising these floods will be, it is estimated, only one-twelfth more as compared with the cost in former years.

The stocks of paying ore remaining in all of the lower levels of the Comstock are believed to be very great. In former years ores of low value were regarded as not worth mining, owing to the high cost of reduction. At present ores realizing only $4 per ton can be mined at a fair profit. It is also believed that ores of as high grade as was ever mined from the lode still exist in the unexplored portions. The reports of all experts unite in supporting, as probable, this theory. That sufficient low grade ores will be found to pay for their extraction, and more than the cost, is a demonstrated fact. It has always been claimed by the geologists of the Comstock lode that the probability of a continuation of the great ore body to an indefinite depth is more than good, and that rich bodies of ore will be discovered, as soon as science, in some way, devises means of moderating the high temperature met with in the lower levels. It is believed that this problem can be solved. Another difficulty of a serious character is the subterranean bodies of water occasionally met with, and which have at times caused serious loss of life, but a pumping plant of large caliber will, it is believed, greatly diminish the danger from this source. The difficulty of mining in a temperature of 120°, sometimes reached in the lower levels of the Comstock, and the dangers resulting from unexpected floods, can be provided for by later appliances than were used when formerly worked.

The Comstock lode was discovered in 1859, and up to the year 1879 it produced ore of the assay value of $363,961,205. The value of its subsequent production is not known exactly, but to place the total to date at $500,000,000 is not considered by well informed experts any exaggeration. The wild speculation following the development of this great lode forms an interesting page in mining history. The abandonment of mining in the lower levels resulted from the exhaustion of high grade ore and the high cost of extraction. Ore in the 1,600 foot level and above is about exhausted. With the draining and ventilation accomplished, development will be resumed, and there are many who believe that great results will follow. The later history of this most wonderful of all lodes of precious metals may prove quite as romantic and miraculous as that of its earlier days.

NEW MACHINE SHOP FOR THE NEW YORK NAVY YARD.

The formal result of the deliberations of Commodore Melville, of the Steam Engineering Bureau, and Commodore Endicott, of Yards and Docks, relative to the erection of a new machine shop at the New York navy yard will be sent to the Secretary of the Navy. It is understood, however, that they favor the construction of a machine shop for naval work on an entirely different plan from the one destroyed. The present idea is to extend the boiler shop toward the dry docks a distance of 400 feet, moving the boiler-making plant to the lower end of the structure and devoting the western end to the machine shop until the new building can be erected on the site of the old one.

The new building will be one story high, 365 feet long, and 150 feet wide; the added depth of 75 feet being taken from the length of the boiler shop. An office and administration building will be constructed, so that the offices will be in no way connected with the shops. The setting-up shop is to be 100 feet deep, and in the space inclosed in the three sides of the square occupied by the buildings provides for a power house to be erected away from the main buildings. The tools and machines for the new shops will be of the most approved pattern, and it is thought that the shop will be the most complete one in the possession of the government and capable of turning out work with great rapidity and accuracy.

A CURIOUS ACCIDENT ON A TROLLEY CAR.

An inspector in the Brooklyn Water Department is now at his home in Brooklyn suffering from an electric shock, which paralyzed him from the waist down, which he received in a trolley car. He boarded the car while it was raining hard. He wore no rubbers, but had on very thick shoes, the heels of which were secured by rows of heavy nails. He stepped from the platform upon the iron plate which forms the threshold of the car, the door of the car sliding back and forth in a groove in this plating. He at once experienced a sharp shock, and the conductor pulled the helpless man away from the plate and carried him to a seat. The other passengers were then sent out of the car; the car was run to the power house, and after a considerable time had elapsed the man was sent home in a carriage.

It is difficult to account for such a severe shock. The pressure carried by the trolley wires is about 550 volts, and the shocks which are ordinarily obtained do not do any harm. It is probable that the injured man must have received the current through the iron nails in the heels of his shoes. It is also possible that the car heaters were improperly wired, and that a loose wire may have touched the framework of the heaters and been thereby conducted to the iron plate which covered the threshold of the door, through the medium of the iron supports of the heaters.

A STRANGE SOCIETY.

The Woman's Rest Tour Association is a curious little society which is now becoming quite well known abroad. It is an association having headquarters at Boston, and it might be termed a mutual bureau for information. The society means to furnish women who travel for purposes of rest and study with such practical advice and encouragement as shall enable them to make their trips independently, intelligently, and economically. It has more than 575 members. There is a library of Baedeker's guide books which are lent to members who may wish to use them on their travels. Foreign and American lodgings are listed in a small paper which appears from time to time, and information is given regarding travel abroad. The membership includes many school teachers of very small means to whom it is vitally essential to make every dollar go as far as possible in a European tour, which is expensive at the best. The association is a remarkable example of women's willingness to help one another.

THE BUILDING OF A WATCH.

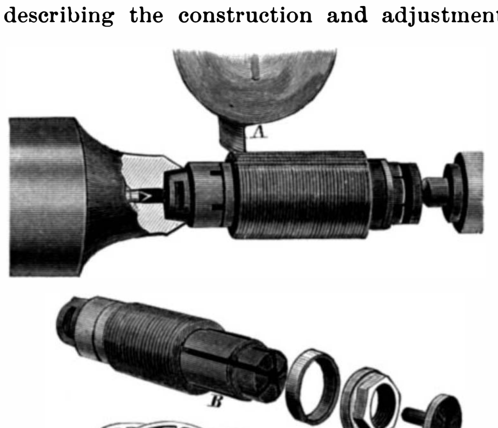
If we were asked to state the most important element in our rapidly approaching industrial supremacy, we would name, without any hesitation, labor-saving machinery. If we were asked where labor-saving or automatic machinery was to be found in its very highest state of development, we would direct the inquirer to visit one of the great American watch factories, which are at once the pride of the watch industry in this country and the despair of all foreign competitors.

Time was when all watches were made by hand; they are largely so made in Europe today, and the prejudice against machine-made watches, based upon the mistaken supposition that they must be necessarily rough in their construction and uncertain in their running, dies a lingering death. The credit for the scheme of applying machinery to watch manufacture belongs to this country, and is due to a Boston watchmaker, Aaron L. Dennison, whose earliest work in this direction dates from the year 1848. Mr. Dennison's theory was that the substitution of special machines for human skill would insure such uniformity of product that similar parts would be practically interchangeable. The cradle of the industry was laid by Dennison and his partners, Howard and Curtis, in a small factory which they started in Roxbury, Mass., in 1850. Four years later the concern was moved to Waltham, and out of this venture, in spite of many early disasters, has sprung the vast establishment known as the American Waltham Watch Factory, where automatic machinery is now turning out watches at the rate of 2,500 a day.

Every one is more or less familiar with the appearance of the mechanism of the watch; but to comparatively few people is given the opportunity of observing the operations of the thousand-and-one machines, most of them marvels of ingenuity, which, with metallic fingers, pick up the crude material—brass, nickel, or steel—cut it into the desired forms in a number of swiftly succeeding operations, pass it from machine to machine, from tool to tool, and finally deposit it, completely fashioned, before the attendant, whose sole duty it is to supply the raw material at one end and receive the finished articles at the other.

There is something almost human and extremely fascinating in the motions of these phenomenal tools, and there is something more than human in the absolute accuracy of the finished product, much of which before it can pass the inspector must be gaged to one ten-thousandth of an inch. The American watchmaker has proved, not only that watches can be made by machinery, but that the machine-made watch has an accuracy of movement superior to that of the average hand-made article. This demonstration was made over twenty years ago at the Centennial Exhibition, where three Waltham watches earned the highest awards for accuracy, by running for ten weeks with a mean daily variation of only twenty-three one-hundredths of a second and an average difference of only forty-four one-hundredths of a second between the first and the eleventh weeks of the trial.

In describing the construction and adjustment of

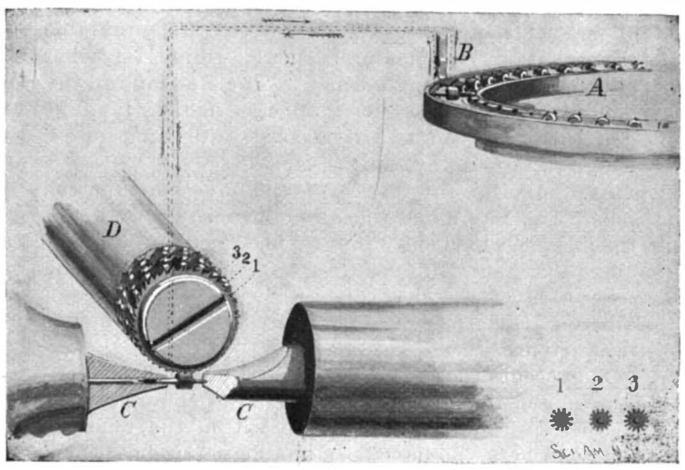


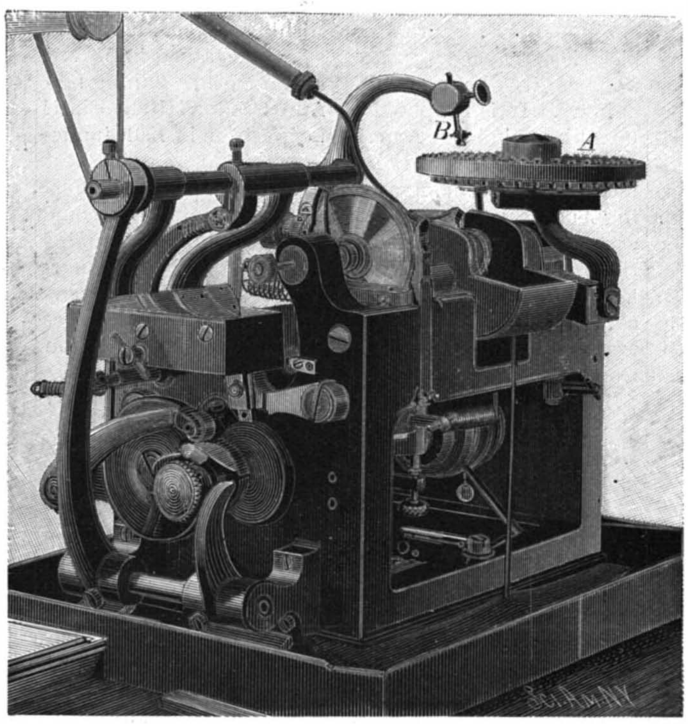
12.—Train Wheel Blanks and Cutting Arbor.

the machine-made watch, we have chosen the Waltham Watch Factory as being thoroughly representative, both in the size of the establishment, the variety and quality of its tools, and the excellence of its product, of the latest development of the watchmakers' art in this country. The factory (Fig. 3), which still occupies the original site, has been entirely rebuilt since 1876. It is a four-story brick structure with a frontage of 746 feet, and six wings which, with the main structure, would make a building nearly half a mile in length. The operatives include about 1,400 women and 800 men, and as the total output is 2,500 watches a day, it is evident that somewhat more than a watch and one-eighth is made by each operative every working day of the year.

Compare this with the work of the hand-labor watchmaker who required nearly three months to produce one high grade watch.

A visitor to the factory has not covered very much of





11.—Automatic Pinion Cutting Machine.

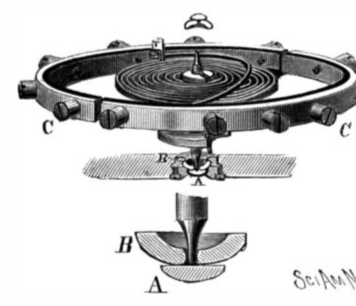
the two-mile journey which is necessary to complete the circuit of the various floors before he realizes that to describe comprehensively or in any detail the building of a watch would require a volume of no small dimensions. This will be understood when we state that an ordinary watch movement is composed of 160 separate pieces, requiring for their production 3,750 distinct operations. For it is to be understood that there is no part of the watch movement which is not made in this factory. It is the aim of the present article to present such a selection of views and as much descriptive matter as will give the reader some slight conception of the rare ingenuity, skill, and accuracy which characterize both the tools and the finished output of this modern watch factory.

A watch may be defined as a self-contained motor of the stored-energy type, whose duty it is to impart motion to a train of gearing, the speed and uniformity of which is regulated or governed by the vibrations of a small balance wheel. The energy is contained in a coiled main spring and is imparted to the balance wheel through a train of gears, which are so proportioned to each other that three of them will complete a revolution respectively in one minute, one hour, and twelve hours, while the balance wheel is vibrating at the rate of five beats to the second, or 18,000 to the hour.

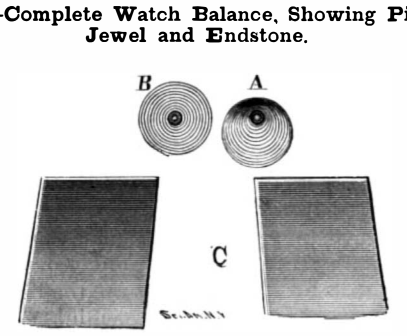
PILLAR AND TOP PLATES.—The various members of the "movement" are carried upon delicate steel axles, which have a pivotal bearing in two plates known as the "pillar plate" and the "top plate," the bearings in the better grades of movements consisting of jewels set in the plates, and with holes of such exactness that the clearance between the pivots and the jewels is only one one-thousandth of an inch.

Blank punchings for the pillar and top plates of the required form are received from the brass mills, where they are punched out of sheet brass or nickel, the latter metal being preferred for the Waltham watches. The preparatory machining is done in the ingenious machines shown in Figs. 4, 6, and 9. The plates are first faced on both sides in a fully automatic machine, of which two are shown in Fig. 9. The operations are shown by the diagram at the top of the cut. About 100 blank punchings are packed face outward in a cylindrical magazine, *A*, from which they are taken one at a time. A similar magazine, *E*, receives the finished plates at the opposite end of the machine. The facing is done by the tools, *F* and *G*. The operation is as follows: As soon as a full magazine of punchings has been put in place, a horizontally swinging arm, *C*, swings in front of *A* and lets fall a carrier, *D*, which seizes one of the plates; the arm then swings around and deposits the plate in the holder at *F*, where it is faced, as shown in the diagram. Another arm on the opposite side of the plate now swings over, picks up the plate, swings over to the next tool (meanwhile reversing the plate so as to bring its opposite face to the tool), and places it in the next holder at *G*, where it is again faced. The third arm then picks it up and carries it over and drops it in front of the receiving magazine, *E*, into which it is pushed by a plunger. The three arms always act in unison, and the motion of the machine is continuous until the magazine has been emptied. The operation is absolutely automatic, the operator merely having to supply another full magazine of plates at regular intervals. Fig. 6 shows a fully automatic machine for recessing the plates, which is even more elaborate, involving no less than seven transfers, which are made by the swinging arms, *C*, *C*, *C*. The problem is complicated by the fact that most of the recesses being eccentric to the plate, the latter has to be centered accordingly on the chucks, *A*, *A*, *A*, after each transfer. This is done automatically, and, as in the machine just described, the attendant has merely to feed the magazines of faced punchings at regular intervals at one end and remove the finished work at the other. When one arm moves, all move, so that a finished plate is turned out at each transfer. Most ingenious of all, however, is the automatic machine shown in Fig. 4, whose duty it is to drill with mathematical exactness as to size and position the holes in the pillar plate, numbering 39 in all. In this machine the magazines, *A* and *C*, are placed vertically, and the transfer arms swing in a horizontal plane. Five transfers are made and each of the turret heads contains six drills. As soon as the plate has been transferred to a new holder, the latter, which has a universal movement in a horizontal plane, moves the plate to the proper position, when the particular drill, corresponding to the required hole, rises from the turret head and drills a hole. The holder then shifts to a new position and the operation is continued until all of the required holes of that particular size have been drilled, then a second drill of a different size is brought into operative position and the operation is continued until about one-fifth of the holes have been drilled. The piece is then transferred by the arm, *B*, to position No. 2, where more holes are drilled, the operation being continued throughout the series.

GEARS AND PINIONS.—The gears are made from sheet brass and the pinions from steel wire. To follow the manufacture of the former, we must first pass to a room in which we see rotary cutters cutting the sheets of brass into long strips, which vary from one-fourth inch to three-fourths inch in width. These strips are then fed by an attendant to a punching machine,



13.—Complete Watch Balance, Showing Pivot Jewel and Endstone.



14.—A Non-magnetic and a Steel Hairspring, Latter Distorted by Magnet.

where the gear blanks are punched out at the rate of 25,000 per day. The little wheels thus produced, ready for the gear cutter, are very perfect, with hub, spokes, and rim complete. Just here it will be well to say that all the parts of a watch that admit of it are fabricated from punchings, and it is in this department that some of the greatest saving of labor is achieved. For such delicate work, of course, the dies have to be made with

the nicest care, and so well is the work done that the punchings are wonderfully clean and true.

By far the most delicate work of this kind is done in the production of minute, hour, and second hands. In this case the metal is too fine to admit of its being punched at a single stroke of the machine. Three operations are necessary. The flat wire is first run through a machine (Fig. 7) which produces rough punchings. These are then swaged in a second machine, which leaves the form of the hand standing out in clear relief; and the superfluous stock is then removed in a third machine, which punches out the delicate hair-like little pointers to finished size. Great care is exercised in preparing the dies for this work. The die is held against a vertical file, of great fineness, which works through a table somewhat after the manner of a jig-saw. The heads of the pointers are polished by means of a hard rubber block, *A*, Fig. 15, and Vienna lime, the former having a rapid reciprocating movement above a small table, *B*, in which is a recess of the exact size and form of the pointers. In order to secure a convex face on the pointers, the table is given a lateral rocking motion.

To return to the gears: The cutting of the teeth is done in a special machine, part of which is shown in Fig. 12. Fifty or more of the punchings are assembled on a split arbor, *B*, which is placed between the centers of the machine. A fly-cutter, *A*, then begins to cut across the gears, the arbor being rotated between each cut by an amount equal to the pitch of the teeth.

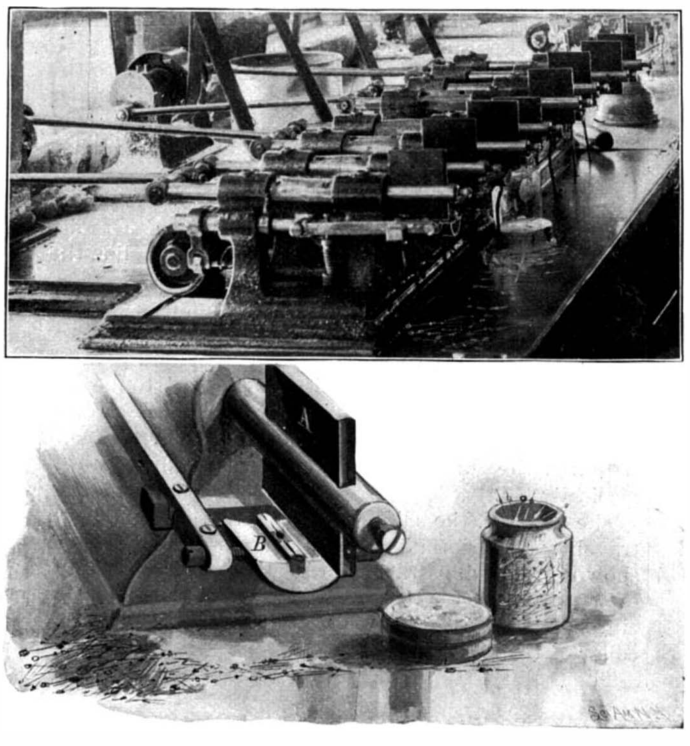
The pinions with the microscopic shafts on which they turn are made out of a special grade of steel wire. They are automatically cut to the right lengths, roughed out and pointed, and then are transferred to the machine (Fig. 11) which cuts the teeth. As it is necessary that these diminutive pieces should operate with the least possible friction, they are cut with epicycloidal teeth, and the cutting is performed by a tool carrying three milling cutters. The pinions are placed in a circular rotating magazine tray, *A*, from which they are picked up by a pair of tongs, *B*, one at a time, and placed between the centers, *C C*. The first cutter saws out the stock, the second shapes it, and the third finishes the teeth with a true epicycloidal curve. The pinions are then hardened and tempered and polished ready to go into the watch.

SCREW MAKING.—In Fig. 8 is shown a little machine which perhaps more than any other appeals to the mechanic as exhibiting the very refinement of ingenuity in automatic mechanism. At one point there is fed into the machine a length of steel wire and at another point there issues from it perfect little screws, many of which are so fine as to call for a magnifying glass to discover at which end is the head and at which the thread. The wires enter long cylindrical split chucks, 1, 2 and 3, etc., see diagram, which are arranged on a rotating head. Opposite, and on each side of the head, are two cutting tools, *A* and *B*. At point 1 the screw is pointed; the head then rotates to 2, where the stock is cut off; at 3 nippers draw the screw forward; at 4 a die, *C*, comes forward and threads it; at 5 the screw is cut off, and a plunger comes forward, seizes the screw and carries it over to 6, where the head is slotted; and finally at 7 a wire passes through the plunger and pushes out the finished screw. A stream of oil is directed constantly at each point where cutting is being done, through the curved pipes, *D*, *D*, *D*. There are in this department 41 of these really wonderful little machines, and their capacity is 175,000 finished screws per day.

TEMPERING AND BLUING.—All the parts of the watch which are made of steel are carefully tempered, and all of them are drawn to some desired color, in the case of the Waltham watches the preferred color being a dark blue. The heating is done in gas furnaces of the kind shown in Fig. 1. The articles to be tempered are placed in small cylindrical boxes, *B*, *B*, several of which are packed together in larger cast iron boxes, *C*, of the kind shown at the bottom of the cut, and covered with powdered charcoal, *D*, the latter being used to exclude the air. The boxes are then placed on a little revolving turntable, *A*, within the furnace and kept there until the contents have been raised to the proper heat. The hardness is then obtained by plunging into oil or water. The coloring is done in the apparatus shown in Fig. 5. It consists of a closed sheet-iron case, *A*, in the bottom of which is a set of Bunsen burners, *B*, which play upon a revolving cylinder, *C*. The articles are placed in a loose cylinder, *D*, which is placed within *C*, and rolls within the latter during the process of heating, the rolling serving to expose every piece fully to the action of the heat. The color is determined by the temperature to which the contents of the cylinder are raised.

THE ESCAPEMENT.—Limits of space forbid our giving a detailed description of that most ingenious and delicate part of the watch known as the escapement, Fig. 16. Its duty is to bring to a full stop at regular intervals every wheel of the train, and after a brief period of rest permit it to start again. It has to do this five times in every second or 18,000 times in the hour. It consists of an escape wheel, *E*, with curiously shaped teeth whose top and side edges are so formed as to impart a rocking motion through the sapphire hooks, *C*, *D*, to a lever, *B*, which rocks upon a pivot, *F*. The upper arm of the lever has at its end a slot, which engages a little sapphire pin, *G*, set in and at right angles to the face of a small disk, *A*, which is mounted on the same staff or arbor as the balance wheel. As the arm, *B*, of the lever or "pallet" rocks, it catches the pin, *G*, within the slot above mentioned, and carries it alternately to right or left, giving it an impulse which causes the balance wheel with its controlling hair spring to vibrate in unison with the escapement wheel. The horns, *C*, *D*, and the roller pin, *G*, are made of some precious stone such as sapphire or ruby. The escape wheel is cut by an automatic machine carrying six cutters, and it takes six cuts to form each tooth. The pallet stones, *D*, *G*, are ground to size in blocks of forty or fifty cut to proper length, and shellacked into the pallet. The jewel roller pin is ground with copper laps and then polished with shell laps charged with diamond dust.

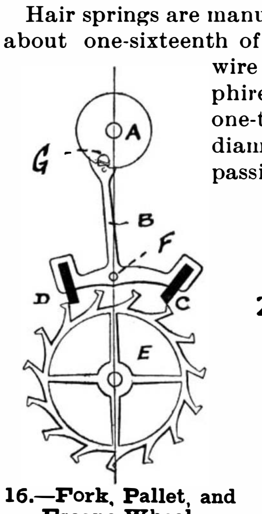
THE HAIR SPRING.—The duty of the hair spring is to absorb the momentum imparted to the balance by



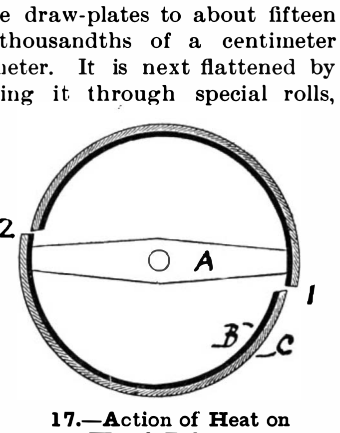
15.—Watch-hand Polishing Machines.

the pallet and fork, bringing the balance to a stop, and then, by virtue of its resiliency, rotate the balance in the opposite direction, bringing the roller pin into position to receive another impulse from the pallet. As it has to do this with the nicest accuracy of time and force, it is evident that the manufacture of the delicate coiled hair spring is one of the most important features of the watchmaker's art.

Hair springs are manufactured from round steel wire about one-sixteenth of an inch in diameter. The wire is first drawn through sapphire draw-plates to about fifteen one-thousandths of a centimeter diameter. It is next flattened by passing it through special rolls,



16.—Fork, Pallet, and Escape Wheel.



17.—Action of Heat on Watch Balance.

and to reduce it to perfect gage, it is drawn through diamond dies. The average hair spring is about nine inches in length. Three of these lengths are wound together inside of a circular bronze box, in which they are heated and tempered, and they are then finished and blued. The springs are next fastened to a brass collet at the center and to a steel stud at the outer end. When the spring is in place in the watch, the collet is fastened to the balance wheel shaft, and the stud to the frame of the watch.

MAKING THE BALANCE.—In making the standard number of 18,000 vibrations per hour the rim of the ordinary balance will travel 3,479 feet, or two-thirds of a mile in the hour, that is to say, about eighteen miles per day. If the motion of a balance should be defective to the extent of making only 17,990 vibrations per hour (only ten below the standard), the watch will lose two seconds per hour, or forty-eight seconds per day—over three-quarters of a minute. Hence we can understand the necessity for making the "balance" live fully up to its name. To make the exact number of vibrations, both its diameter and its weight must bear an exact ratio to the strength both of the main spring and the hair spring, not merely at the time it is inserted in the watch, but under all the possible conditions of service. It is necessary, therefore, that the elastic strength of the hair spring should be at all times invariable. If, for some cause, such as change of temperature, it should increase, the frequency of the vibrations of the balance would increase, and vice versa. Moreover, the length of the spring is constantly changing. It lengthens with a rise and shortens with a fall of temperature. As it lengthens, the frequency of the vibrations reduces; as the spring shortens, it increases. Hence, unless some automatic compensation is introduced, the balance will vibrate faster in winter and slower in summer.

The compensation is introduced by so constructing the balance that the heat which weakens the elastic force of the hair spring serves at the same time to reduce the diameter of the balance, so as to exactly adapt it to the force which the weakened spring is capable of exerting. To secure this end the balance is made of two metals, steel and brass. The arms, *A*, and inner portion, *B*, of the rim (Fig. 17) are made of steel and the outer portion of the rim of brass, the metals being carefully fused together in a special furnace (Fig. 2). The rim is cut through on opposite sides at 1 and 2, the point of severance being located close to the arms, *A*. Now, since the expansion and contraction of brass is nearly double that of steel, it follows that under a rise of temperature the two halves of the rim will be curved inward, as shown in Fig. 17. This brings the center of gravity of the rim nearer the center of the wheel and lessens the degree of force that must be applied to give it a certain rate of vibration. Similarly, under a fall of temperature, the brass in the rim contracting more than the steel will tend to curve the rim outward, enlarging its diameter; consequently, in cold weather the balance enlarges as the spring shortens and in warm weather it grows smaller as the spring lengthens, the compensation being wonderfully accurate. The little screws, *C*, *C*, around the rim serve two purposes. First, by increasing or reducing their number, we can change the actual weight of the balance; second, by changing their position on the two halves of the rim and placing them nearer to or farther from the ends, we can change the effective weight of the rim in respect of vibration. For a screw placed near the supporting arm will not, under the changes of diameter due to temperature, be so effective as one placed near the point of severance of the rim. Hence, by shifting these screws, it is possible to secure a marvelous nicety of adjustment, so exact that, as we pointed out early in this article, a watch can be made that will not vary more than twenty-three hundredths of a second in a day.

To facilitate the turning of the balance, the fine needle-like ends of the staff on which it is carried are borne by small end jewels, *A*, Fig. 13; and the holes in the jewels, *B*, in which the staff turns are rounded. The bearing surfaces are so proportioned that the friction is the same whether the watch is in a horizontal or perpendicular position.

Experience has shown that the best constructed balance may vary from five to one hundred and twenty-five seconds per hour when subjected to the influence of magnetism. Polarization of the parts of the movement demoralizes the sensitive hair spring and balance. In Fig. 14 are shown two hair springs, *A* and *B*, which are mechanically identical. The spring, *A*, however, has been polarized, and the effect when the two are brought near a magnet is very marked. One of the greatest achievements in modern horology has been accomplished by the Waltham Company in substituting for steel as used in the balance, roller, hair spring, and pallet and fork, metals or alloys which are non-magnetic, but which possess the properties of elasticity and expansion in such relative proportions as to enable them to compensate for the varying conditions of heat and cold.

With this brief mention of what may be considered as the last and greatest triumph of the watchmaker's art, we close our description, necessarily all too brief and fragmentary, of one of the most characteristic and successful of our American industries.

BUDDHA'S tooth, presented by the people of Burma to a temple in Ceylon, has been seized by the custom house officers. The relic is inclosed in a jeweled case. The Burmese do not wish to pay any duty, and appealed to the Secretary of State for India for relief.

A PERCOLATOR PACKAGE FOR MAKING COFFEE.

The accompanying illustrations represent a novel percolator package or bag which has recently been invented by Henry M. Humphrey, 4 to 8 Water Street, Brooklyn, New York, and which is designed to contain the coffee to be boiled or infused. The bag is made of a porous fabric, such as muslin or cheese cloth, and is provided with a weight which keeps it in proper position in the water. The weight assists the package in its downward course, and serves constantly to change the position of the package, so that the hot water is always in contact with the coffee.

Of the accompanying illustrations, showing the various positions assumed by the percolator package in a coffee-pot, Fig. 1 represents the first action of the weight in drawing the slack bag down into the water. In a few minutes the bag assumes the position indicated in Fig. 2. As the water boils up the bag rises, as shown in Fig. 3, the weight serving to keep the swelling coffee in the hottest part of the water. When the boiling is stopped, the bag sinks to the position represented in Fig. 4; and the coffee is then ready to be served.

Although it is intended that a clean percolator bag be used every time that coffee is made, it is, nevertheless, possible to use a bag several times. This new method of making coffee, it will be observed, does away with the possibility of leaving grounds in the coffee-pot, and does not require the use of eggs in causing the coffee to settle.

HUMPHREY'S PERCOLATOR PACKAGE FOR MAKING COFFEE.

The Inventors' Bank in Austria.

The Austrian government has granted provisional concession for an Austrian inventors' bank. The company's capital is to consist of $100,000 in shares of $80 each. The amount can be eventually raised to $200,000 and to $400,000 on ratification by the government and stockholders. The statutes designate the aim of the company to be the utilization of inventions and patents for the mutual benefit of the inventor and the bank, which may involve the erection of factories for such patented articles, the founding and management of trade enterprise for the sale of these articles, and the right of the bank to carry on all other legally licensed businesses which are adapted to encourage the activity of the inventors in Austria. If the capital for the new enterprise is not procured at the end of six months, the concession will be withdrawn. Such an establishment, if indorsed by the government and administered by fully reliable parties, cannot but prove of interest to the inventor.

Trade Relations Between Germany and United States.

A good deal of unnecessary anxiety seems to be exhibited both in Germany and in the United States about the trade relations between the two countries. Some figures just prepared by the Treasury Bureau of Statistics showed that the supposition that American trade in Germany or German trade in America is being disturbed or depressed by existing conditions seems to be unfounded. Certainly the United States is giving to Germany a larger percentage of her import trade than ever before and is selling to Germany a larger percentage of her exports than ever before. American exports to Germany increased over 11 per cent in the past six months compared with the corresponding six months of the preceding year, which of themselves were phenomenally large, and the imports from Germany into the United States in the past six months were nearly 25 per cent greater than those of the corresponding six months of last year. The share of our import trade given to Germany has steadily increased during the past decade, as has also the share which she takes of our exports. A decade ago 10 per cent of our imports was taken from Germany, while now 13 per cent comes from that country; a decade ago 8 per cent of our exports went to Germany, now over 13 per cent goes to that country, and in the last half of the calendar year 1897 our exports to Germany were $32,632,122, and in the last half of the calendar year 1898 were $40,615,770, an increase of nearly 25 per cent. Our exports to Germany in the last half of the heavy export year 1897 were $77,132,053, and in the last half of 1898 were $85,903,120. Even in meats and provisions the exports to Germany in 1898 show a marked gain in nearly all classes. In salted or pickled beef the exportations increased more than 25 per cent in 1898 over 1897. Exports of bacon increased 25 per cent, or nearly 10,000,000 pounds; those of hams increased from less than 5,000,000 pounds to nearly 12,000,000 pounds; those of pork, fresh and salted, from less than 3,000,000 pounds to nearly 13,000,000 pounds; those of lard, from 205,000,000 pounds to 238,000,000 pounds; while in fruits and nuts the exports of 1898 were nearly 50 per cent in excess of those of 1896, and but slightly below those of 1897.

A SIMPLE PIPE CUTTING AND THREADING TOOL.

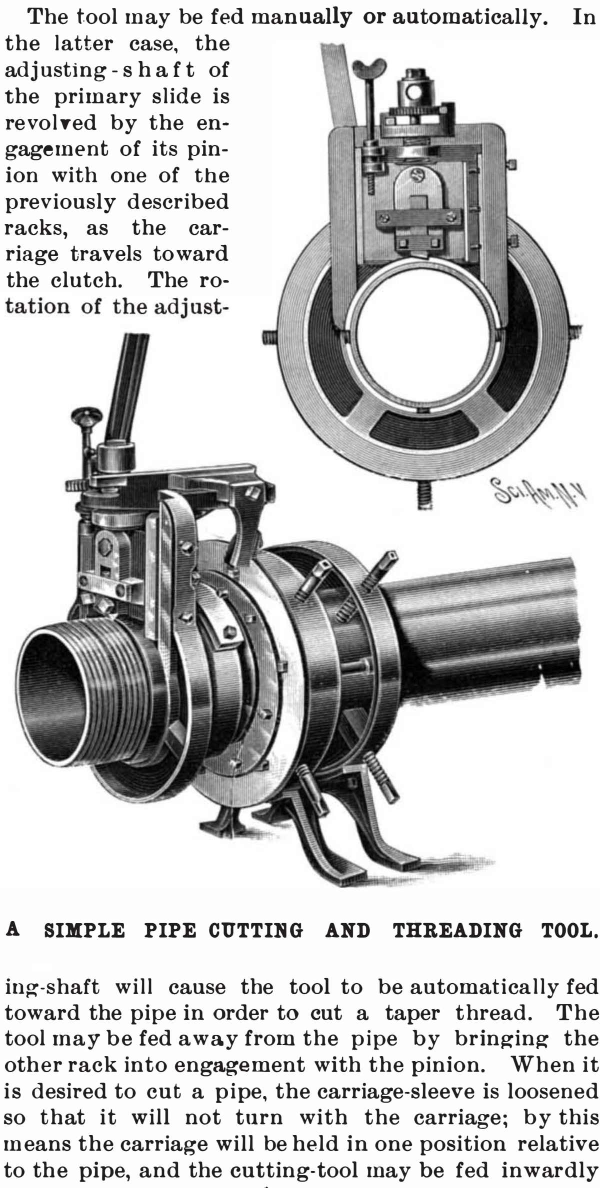
The improved pipe cutting and threading tool illustrated herewith is designed to be used on pipes of various diameters, and to take the place of the usual costly pipe-cutting machinery which can be used only in the shop.

The tool is designed to be attached directly to the piece of pipe which is to be threaded or cut off, and is held in place by means of a universal chuck having a threaded and flanged collar surrounding the pipe. In connection with the chuck, there is also provided a carriage having a threaded sleeve engaging the collar. Upon the carriage two slides are mounted—a primary slide and a secondary slide. These slides are connected by an adjusting bolt having a swivel whereby the two slides can be separated and drawn together. By means of this device the two slides can be separated so as to adjust the cutting-tool nearer to the center when it is desired to thread a smaller pipe. The primary slide is directly in contact with the carriage, and the secondary slide is mounted to move on the primary slide. The primary slide may be moved toward or from the pipe by means of a radial adjusting shaft. To the secondary slide the tool-holder is pivoted.

The carriage has a longitudinally extended portion which is provided with guides receiving two rack-bars which extend parallel with the pipe and are adapted to be engaged by a pinion on the upper portion of the adjusting-shaft of the primary slide. By means of this construction the threading or cutting tool can be automatically fed.

The carriage, the slides and the tool are made to travel by means of a long handle, a portion of which is shown in the illustration. As the carriage passes about the pipe it is gradually worked toward the clutch, as the sleeve on the carriage moves along the collar of the clutch.

The tool may be fed manually or automatically. In the latter case, the adjusting-shaft of the primary slide is revolved by the engagement of its pinion with one of the previously described racks, as the carriage travels toward the clutch. The rotation of the adjusting-shaft will cause the tool to be automatically fed toward the pipe in order to cut a taper thread. The tool may be fed away from the pipe by bringing the other rack into engagement with the pinion. When it is desired to cut a pipe, the carriage-sleeve is loosened so that it will not turn with the carriage; by this means the carriage will be held in one position relative to the pipe, and the cutting-tool may be fed inwardly by hand, until the pipe has been severed.



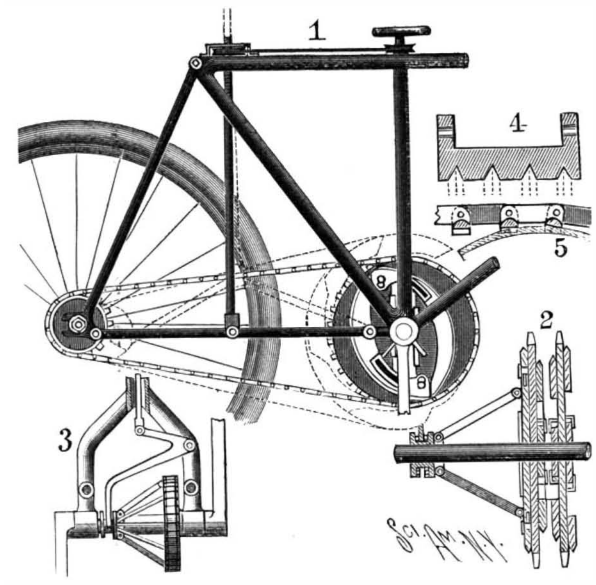
A SIMPLE PIPE CUTTING AND THREADING TOOL.

The tool has been patented by the inventors, Ferdinand C. Walter and Herman F. Repkow, of 149-151 East Huron Street, Chicago, Ill.

A VARIABLE BICYCLE DRIVING-GEAR.

An ingenious mechanism has been invented and patented by Charles G. Evans, of Nelson, British Columbia, Canada, by means of which the driving-gear of a bicycle may be changed to any degree of speed between two extreme points.

Fig. 1 is an elevation showing the device applied to a bicycle. Fig. 2 is a sectional view of the sprocket-wheel. Fig. 3 is a fragmentary front elevation showing the means for controlling the sprocket-wheel. Fig. 4 is a cross-section of a link of the sprocket-chain. Fig. 5 is a detail section showing the action of the sprocket-chain on the sprocket-wheel.



EVANS' VARIABLE BICYCLE DRIVING-GEAR.

From the top bar of the bicycle there extends downwardly a vertical front brace, forked at its lower end to carry the crank-shaft. From the rear end of the top bar there extends a diagonal brace likewise forked and joined to the fork of the previously mentioned brace. The rear wheel is held in a fork pivoted to the rear end of the top bar. For the usual back stays of the bicycle, toggle-links are substituted, which are pivotally connected with a forked, link-controlling rod running vertically through the top bar. On the rear portion of the top bar is a nut engaging a thread on the link-controlling rod. The nut is grooved to receive a band which runs to a pulley carried on the front portion of the top bar and operated by a hand-wheel. The hand-wheel also controls a rod, which runs through the front brace, and which is provided at its lower end with a bell-crank lever, engaging the sprocket-operating devices (Fig. 3).

The main driving-wheel consists of two sprocket-sections, as shown in Fig. 2, on each side of which sections, extension plates are held to slide. These plates are pivotally connected with links, which are in turn pivoted to a collar sliding on the crank-shaft and engaged by the lower member of the bell-crank lever, shown in Fig. 3.

By turning the hand-wheel on the front portion of the top bar, the rod extending through the forward vertical brace will be caused to operate the bell-crank lever in order to adjust the sprocket-wheel. When the hand-wheel is turned in one direction, the collar of the crank-shaft will slide and cause its links to force the extension plates radially outward, as shown by dotted lines in Fig. 1. When the hand-wheel is turned in the opposite direction, the extension plates will be retracted.

The sprocket-chain, as indicated in Fig. 4, consists of links, the under surfaces of which are formed with four V-shaped grooves running longitudinally with the chain and designed to engage the edges of the extension plates. When the plates are extended in the manner before described, they will grip the four V-shaped grooves of the chain links as shown in Fig. 5. Simultaneously with the extension of the driving-wheel, by means of the hand-wheel, the toggle-links between the rear wheel and the crank-shaft will be raised by means of the rod pivoted to their inner ends and connected with the hand-wheel by the band passing around the rod-nut and the hand-wheel pulley. In this manner the variations in diameter of the driving wheel and the change in position of the rear wheel are compensated for.

It will be observed that the gear is not limited in its changes to a fixed set of speeds, but that the adjusting devices and the construction of the driving sprocket-wheel enable the bicycle to be geared to any degree within the two extremes.

AN Italian medical journal states, according to The New York Medical Journal, that while water will not quench the flame of burning petroleum in a limited space, milk accomplishes the object by forming an emulsion with the oil, disturbing its cohesion, and thus attenuating the combustible element.

Science Notes.

The statue of Von Helmholtz by Herter is completed. It will be placed in the court of the University at Berlin, between the statues of the two Humboldts.

Vienna has begun the construction of bicycle paths through the streets. Ground has been conceded for the purpose of building a new street on condition that a strip be prepared for the use of bicyclists.

A young French artist is the discoverer of a fine and genuine example of the Spanish painter Velasquez. The canvas was found on a recent tour to Spain. It is a life sized portrait of a man and is in the best style of the master. It has been submitted to eminent critics who have pronounced upon its genuineness.

The city councilors of Ulm, Germany, have decided to utilize the spire of their magnificent cathedral as a meteorological observatory. The spire is one of the highest buildings in the world. The instruments will be supplied by the Royal Observatory at Stuttgart, and the registrations will be made by the watchmen of the cathedral under the direction of Dr. Schimpf, a meteorologist. Next to the Eiffel Tower in Paris, the cathedral spire of Ulm will be the highest artificial post of meteorological observation in the world.

Letters have recently appeared in The London Lancet, in reference to the colors of newly born negro children. Several medical men have given the result of their experiments, and the evidence shows that the children are of the color of a light quadroon. It is recorded, in a paper published in The Journal of the Anthropological Institute, of the natives of the Warri district of the Niger Coast Protectorate that when pure negroes are born they are pink like young rats, but at the end of three or four months they become black. From this it would seem that atmospheric conditions seem to be necessary to produce the full black colored negro.

The Park Department of Boston has for a long time thought that parks were something more than simply inclosures where citizens and their children could walk dressed up in their best and look at the grass and trees. Playgrounds have been provided in different parts of the city and in these the children can play in the sand and make mud pies to their hearts' content, while older ones have outdoor gymnasiums and ball grounds to attract them from the sickening and vicious life of the pavements. The idea is an excellent one, as it is a one-sided policy to neglect a child's physical development while spending large sums upon the equipment and maintaining of schools for its mental training.

Four submarine mines broke away from Castle Island and floated on the beach at Marine Park, at South Boston, Mass. For a time it was thought they were floating barrels, but when their real nature was discovered they were taken to a place where there would be no danger of premature explosion. It appears that the mines had been anchored in a little cove at the southerly end of Castle Island. They were placed there in order that they might be exploded as soon as the weather permitted. The storm was sufficient, however, to sever the mooring lines which held them together as a group, which accounted for their going adrift.

A very curious case of telegraphic disturbance is reported from Utah, where the Oregon short line lost six telegraph wires for a distance of eighty miles north of Ogden, Utah. It was found on inspection that the cross arms and insulators were heavily coated with salt varying from one-sixteenth to a quarter of an inch in thickness. This coating, when wet, taken in connection with the snow lying on the cross arms, formed a dead cross. During the middle of the day, when the sun was shining brightly, the salt appeared to dry out and the wires could be used to some extent. When the cause of the trouble was determined, an engine was started out equipped with a large hose which was used with hot water for washing off the coating. The salt was carried by the winds blowing over the Great Salt Lake, and as salt is a conductor of electricity, the short circuiting of wires is easily explained.

A cable dispatch from Paris, dated January 28, says that an important discovery was announced in the French Academy of Medicine, by M. Georges Jaubert. He has been experimenting on the supply of air, or the renewal of oxygen in atmospheric air for the use of a man in a hermetically inclosed space like a diving bell. He believes that 79 per cent of nitrogen contained in respirable air remains intact after 21 per cent of the oxygen has been consumed, and the same nitrogen mixed with another fresh supply of oxygen becomes respirable air when the carbon dioxide and the water vapor produced by breathing are removed. He found that his hypothesis was correct, and it is stated that he had discovered a chemical substance which by contact with the atmosphere clears the vitiated air of all the impure gases produced by respiration and refurnishes automatically the requisite quantity of oxygen. The author states that six or eight pounds of this substance will enable a man to live for a whole day in a diving bell.

Miscellaneous Notes and Receipts.

The Porcelain Gate at Nanking.—In 1430 of our era, after nineteen years of incessant work and an expense of almost $4,000,000, the Chinese government finished the wonderful porcelain gate of Nanking, which remained in existence until 1856, i. e., for almost four and one-half centuries. It was octagonal in shape, 260 feet in height, having nine stories, each with a cross and a gallery. One hundred and fifty-two bells were fixed thereon in such a manner that every motion of air moved them to and fro, causing a constant ringing. —Keramische Rundschau.

A quickly hardening cement is obtained, according to the Deutsche Maler Zeitung, by cooling off blast furnace slag in the promptest manner. The slag sand thus obtained is mixed with slaked lime and well intermixed in mortar engines. This mortar is allowed to harden in moderately thick layers on the paved ground, and after solidifying is broken into pieces of suitable size. These are burned in a furnace at red heat and then ground in mills into fine powder. By regrinding cement already solidified, and the addition of slag sand and lime, it is in one's power to more or less retard the solidification.

A new coating, which is said to successfully protect posts and other timber surrounded by earth from rotting, is given by the Baugewerkszeitung. Take resin, 50 parts; finely crushed chalk, 40 parts; fine white sharp sand, 500 parts; linseed oil, 4 parts; native red cupric oxide, 1 part; and sulphuric acid, 1 part. First heat the resin, the chalk, the sand, and the linseed oil in an iron kettle, then add the oxide and the sulphuric acid with caution, mix everything carefully and paint the wood with the hot mass, using a strong brush. If the mixture is not liquid enough, it is diluted with a little linseed oil. When the coating is dry, it forms an extremely hard varnish, which allows no moisture to enter.

Innovation in Decorating China.—The process of porcelain painting heretofore consisted in baking the moulded porcelainware at once with the glaze and to paint the finished article afterward with colors, which were then burnt in at a slight heat either in groups or singly in succession, thus not infrequently causing the piece to crack and destroying the whole work of the painter. The new method is based on colors which are applied on the dead-baked, unglazed porcelain, the so-called bisque, and are burned in simultaneously with the glaze in the sharp fire at a temperature of 1,600° C. A greater permanency of the decoration is insured thereby and the colors protected by the glaze receive luster and adhere more intimately to the porcelain, because they are fused with the glaze. The whole is of a handsome harmonizing effect which is more adapted to the article than that produced by the former method.. The said process relies on the resistance of the new colors to such high temperatures as are necessary for the glazes, while the old colors used heretofore were destroyed at considerably lower temperatures.—Zeitschrift des Vereins Deutscher Zeichenlehrer.

Decorating Glass and Distinguishing False Diamonds by Means of Aluminum.—According to a discovery by Mr. Charles Margot, assistant at the physical cabinet of the Geneva High School, aluminum seems to be destined to play an important part in the decorative arts. Mr. Margot found that, with a pencil of aluminum, distinct writing can be done on smooth surfaces of materials containing silicic acid, such as glass, porcelain, etc., and that the letters adhere so firmly to the respective materials that even continued rubbing with moist substances will not remove them. If the characters are treated with strong hydrochloric acid or caustic potash, the metal disappears gradually, but leaves on the writing surface traces as if etched. Hence the soft metal must actually enter more or less into the hard, siliceous substance by virtue of a yet unexplained power. An indispensable condition for the production of distinct characters or designs is a most thorough cleaning of the surface and the removal of even the slightest traces of grease by polishing with chalk, as even the thinnest grease layer would disturb an intimate connection between surface and pencil. Shortly before writing the material is coated with a thin water layer by breathing on it, whereby an easier touch of the pencil is effected. The metallic characters and designs can be given such a luster by treatment with the burnisher and oil that it is not possible to distinguish them from works of inlaid silver. Magnesium, cadmium, and zinc also possess this writing capacity for glass and similar materials, but their easy oxidability renders them too perishable and without permanent gloss.

Furthermore, this property of the said metals to act upon substances containing silicic acid can be practically utilized for distinguishing genuine diamonds from the imitation article. The latter, as regards fire, cannot, sometimes, be distinguished from genuine ones, although they are but paste, as a rule. But they are characterized as such, beyond a doubt, by aluminum, magnesium, cadmium, and zinc pencils.—Deutscher Uhrmacher Kalender.

Great Britain Our Best Customer.

Great Britain continues to be the greatest customer of the United States, despite the fact that our purchases from her continue much below those of former years. The figures of the Treasury Bureau of Statistics covering the calendar year exports and imports show that our sales to the United Kingdom in the year 1896 were $538,661,787, against $482,695,024 in 1897, while our imports from Great Britain in 1898 were but $111,-361,617, against $159,002,286 in 1897. Thus our sales to the United Kingdom are nearly five times as much as our purchases from her. The exports to the United Kingdom increased $56,000,000 over those of 1897, while at the same time the imports from that country into the United States were decreased $48,000,000.

The following table shows the value of leading articles imported into the United Kingdom from the United States in the calendar year 1898 compared with 1897, as shown by the "Account of Trade of the United Kingdom" for the month of December, and the calendar year, just received by the Treasury Bureau of Statistics:

Articles	1897	1898
Wheat	£20,193,864	£24,743,021
Bacon	5,353,624	6,438,239
Lard	1,927,162	2,796,281
Copper, unwrought	1,474,578	2,058,820
Raw cotton	24,557,513	27,513,032
Leather	2,606,406	3,036,811
Hams	3,411,559	3,651,414
Hops	280,453	838,074
Tallow and stearine	240,617	538,243
Fresh beef	4,609,130	4,677,341
Indian corn	6,623,230	7,314,935
Oats	1,913,478	2,294,021

These reductions in our imports from the United Kingdom are, however, merely an incident of the general reduction in our imports, which during the calendar year 1898 were $107,637,000 less than those of 1897. Indeed, the United States is proportionately to her imports a better customer of the United Kingdom than the average foreign country. The countries of the world, omitting the British colonies, took but about 15 per cent of their imports from the United Kingdom, while the United States in 1898 took over 17 per cent from the United Kingdom. Indeed, our purchases from that country were far in excess of those from any other part of the world, being 50 per cent in excess of those from Germany, double those from France, more than the total from Asia, Africa, and Oceanica combined, and more than one-third of the entire importations from Europe.

The reduction in our purchases from the United Kingdom during the year 1898 has been altogether in the class of articles whose manufacture is being increased in the United States, and in certain raw materials of which last year's importations were in the early part of the year abnormally large, as shown by the following statement of exports from the United Kingdom to the United States given in the official reports of the British government for the year ending December 31, 1898, compared with those of 1897:

Articles	1897	1898
Beer and ale	£159,796	£146,113
Salt	94,405	81,146
Spirits	160,242	145,941
Wool, sheep and lamb's	1,238,285	128,503
Cotton piece goods	1,508,246	1,247,856
Jute piece goods	1,253,494	840,198
Linen piece goods	1,925,861	1,634,288
Worsted yarn	67,623	13,475
Woolen tissues	868,574	276,501
Worsted tissues	2,431,221	764,761
Tin plates and sheets	927,751	683,913
Alkali	439,706	169,221
Bleaching materials	236,886	194,309
Earthen and china ware	643,323	534,209
Carpets	53,970	43,699
Worsted yarn	67,623	13,475
Apparel and slops	54,380	46,462
Paper	58,951	47,285
Cement	107,177	87,875
Hardware, unenumerated	154,463	85,891

A Locomotive for Columbia University.

A full sized locomotive, built and presented by the Baldwin Locomotive Works, has recently been placed in the laboratory of mechanical engineering at Columbia University, and will be used to give the students proper instruction in the construction and operation of locomotives. It has been set in position on a short length of track at the western end of the engineering laboratory. Of course, means must be provided to prevent any actual forward movement of the engine, and this is accomplished by a set of friction wheels which support the driving wheels and are free to revolve with them. Resistance to these wheels is obtained by four large brakes which are each capable of taking up 400 horse power. They also act as dynamometers and serve to measure the power. When the locomotive is running at a speed of 40 to 45 miles, 1,600 horse power has to be taken care of. There is also a draw-bar pull amounting to 20,000 pounds. The measuring device is applied so that the hauling power of the engine at various speeds can be ascertained. The mechanical engineering laboratory will soon be one of the finest equipped laboratories in the country, if not the finest.

RAISING SUNKEN VESSELS.

The usual method of setting afloat a vessel that has sunk at a place where the water is not very deep is based upon the principle of closing all the apertures in the submerged part of the hull and then pumping out the water. Such an operation, however, is not unattended with difficulty, since, in addition to fothering the leaks, it is necessary to have the hull and deck carefully strengthened by divers, in order to permit them to support, without yielding, the great pressure that is applied to their surface at the time of exhausting the water.

Vessels that have simply sunk without sustaining any serious damage, and the larger part of which remains above water are usually more easy to raise; but in order to set afloat such as have sunk to a considerable depth in mud or sand, it is necessary to overcome the great friction that the grounded portions exert upon the bottom. With vessels of medium size this is effected only with difficulty, and when it comes to having to do with the great modern ships of war it is necessary to have recourse to special processes, since the traction effected by tugs would, as a general thing, be inadequate to disengage them. As it is impossible directly to overcome the friction opposed by the bottom, the idea has occurred to suppress it by disintegrating the mud or sand either by means of jets of water under pressure or of suction dredges, or even, in certain cases, by means of the two systems combined.

Two interesting examples of such methods have recently been described, one of them applied to the Russian cruiser "Rossia," which sank in shallow water in the river Neva near Saint Petersburg, and the other to the British armorclad "Victorious," which ran aground to the northeast of the jetty of Port Said.

The "Rossia" measures 480 feet in length between perpendiculars, 75 feet in width and 24 feet in depth. With a full load, she displaces 12,200 tons. At the time of the accident her displacement was 10,800 tons. She settled to a depth of about 30 inches into a bed of fine and muddy sand, mixed with a large proportion of pebbles, and, as a consequence of the lowering of the level of the water, exerted upon the bottom a pressure of 2,500 tons. Unfortunately, it was in the month of November, and the river having frozen over, the ice formed so thick a layer around the hull that the effort to break it had to be abandoned. It having been reported by divers that the stern was free and that the lateral keel on the left side was free also for nearly its entire length, an endeavor was made, but without success, to float the ship by pulling her sideways. The school of divers of Cronstadt was then put in charge of the operations. The divers donned their suits under a tent set up on the ice (Fig. 1), and descended two at a time, accompanied with electric lamps and telephone apparatus, and were able to stay under water for half an hour.

The idea occurred to make a diagram of the bottom upon which the ship lay, and to this effect the hull was divided into ten parts, each marked with a white line. The divers were lowered successively in each of the vertical planes determined by the lines, and, by means of rods placed against the lateral keels, succeeded in taking (and transmitting by telephone) a series of levels, which, combined with the successive frames of the vessel, the draught of water, etc., allowed her position to be obtained with great accuracy. In order to disintegrate the sandy bottom of which we have spoken, there was tied up alongside of the vessel a lighter that carried a force pump of which the pipe was 25 inches in diameter. The divers inserted this pipe into the bottom beneath the keel to such a depth that its lower extremity was about 25 feet beneath the surface of the ice. In this way they succeeded in softening all the parts in contact. The direct exploration of the bottom (which they proceeded with after the stoppage of the pump), as well as the settling of the cruiser both fore and aft, permitted of ascertaining the results obtained. The operation, which was begun on the 19th of November, was finished with entire success on the 15th of December. It was, of course, much prolonged by the preliminary studies of which we have spoken and by the freezing of the river. On another hand, the vessel was not placed in a dangerous condition, as was the "Victorious," as we shall see, and the duration of the work was not as lengthy as it was in the case of the latter.

Fig. 1.—OPERATION OF RAISING THE CRUISER "ROSSIA."

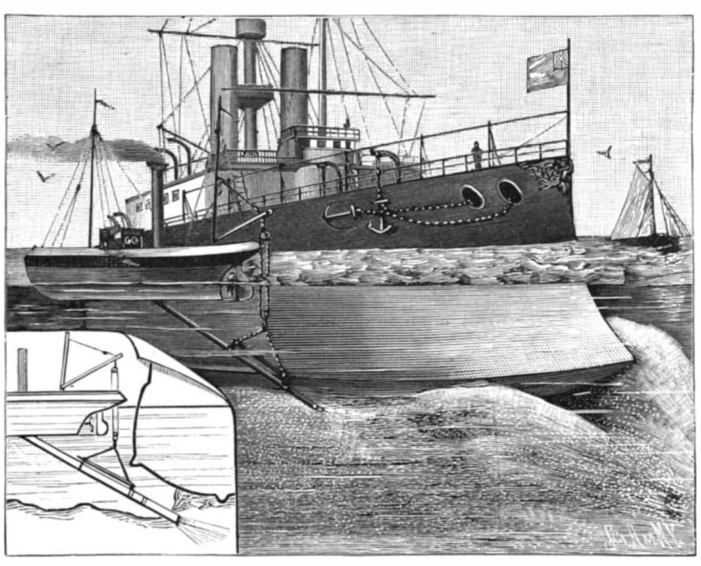


Fig. 2.—DISINTEGRATING THE MUD AND SAND UNDER THE "ROSSIA."

This ship (Fig. 3) is one of the most powerful of the British navy. She is 390 feet in length, and 75 in width, and draws 27½ feet of water. She has a displacement of 15,140 tons and has a speed of 18 knots. On February 14 last, just as she came in front of the prolongation of the jetties of Port Said, she was driven toward the east under the influence of the wind and a very rough sea. After endeavoring, unsuccessfully, to make a resistance with her engines, she let go in succession two anchors, the chains of both of which snapped. Reduced to a state of helplessness, she ran aground, in 25 feet of water, and about a mile from the extremity of the jetties.

An attempt was made in the first place to displace the vessel by connecting her stern with two tugs that, both together, developed 1,500 horse power. But this merely caused her to turn about; with the advantage, however, that it placed her head in a better direction. On the next day (February 15) the operation was resumed, this time at the bow, but without any appreciable result. However, in hauling upon one of her anchors, the vessel was made to slide upon the bottom for about 300 feet. At the same time, the crew proceeded to unship the coal and some of the projectiles in order to lighten the vessel and permit her to float as soon as she should reach a depth of 26 feet.

As may be seen, the results were but middling. At this point, M. Quellennec, engineer-in-chief of the Suez Canal Company, made a proposition to the commander of the "Victorious" to excavate a canal under the ship by means of a suction dredger operating on the port side and of two tank boats provided with force pumps that should direct upon the starboard side jets of water under pressure against the bottom. Fig. 4 gives a representation of the work.

The suction dredger, lying abreast of the ship, was held on the side of the offing by two anchors through which it was hauled from stem to stern and reciprocally. The debris sucked up was thrown back into the sea. At the same time, the jets of water of the tank boats kept disintegrating the muddy sand on the starboard side, and the tugs kept pulling away. All at once, on the morning of February 17, the vessel started forward a hundred and fifty or two hundred yards, and then foundered anew. This spurt caused the cables that connected the vessel with the dredger to snap, but fortunately no injury was done. The operations were resumed at half past seven o'clock in the evening; but in order that the dredger might move at the same time as the ship, no anchor was thrown out from it. Half an hour later, the "Victorious" began to start forward with slight jerky motions and then commenced to float. This was at eleven o'clock at night. On the next morning, at daybreak, the dredger was anchored near the shore, and the ship, completely disengaging herself, was in a condition at eight o'clock to be towed to a depth of 35 feet, where she became mistress of her own movements. From the 17th of February, at noon, to seven o'clock on the morning of the 18th she had made a passage of 450 yards in water 25 feet deep, that is to say, 22 inches less than her draught.

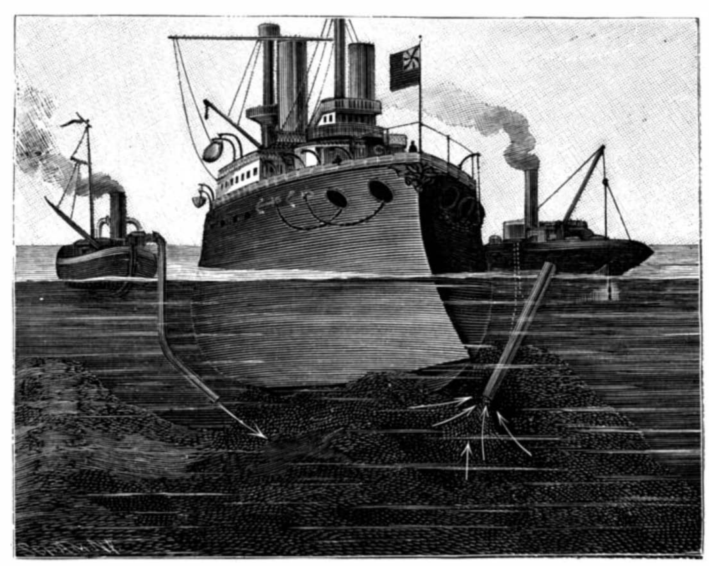


Fig. 4.—OPERATION OF SETTING THE "VICTORIOUS" AFLOAT.

The operation was, therefore, entirely successful and the British armorclad was drawn out of a very critical position, since, in a bottom of sticky sand like that in which she ran aground, the adhesion of the keel is such that a foundered vessel may, under the influence of the tides that necessarily hollow the bed, chance to sink progressively up to the masthead. Such a disaster has happened several times, especially in the roadstead of Bilbao. For the above particulars and the illustrations, we are indebted to La Nature.

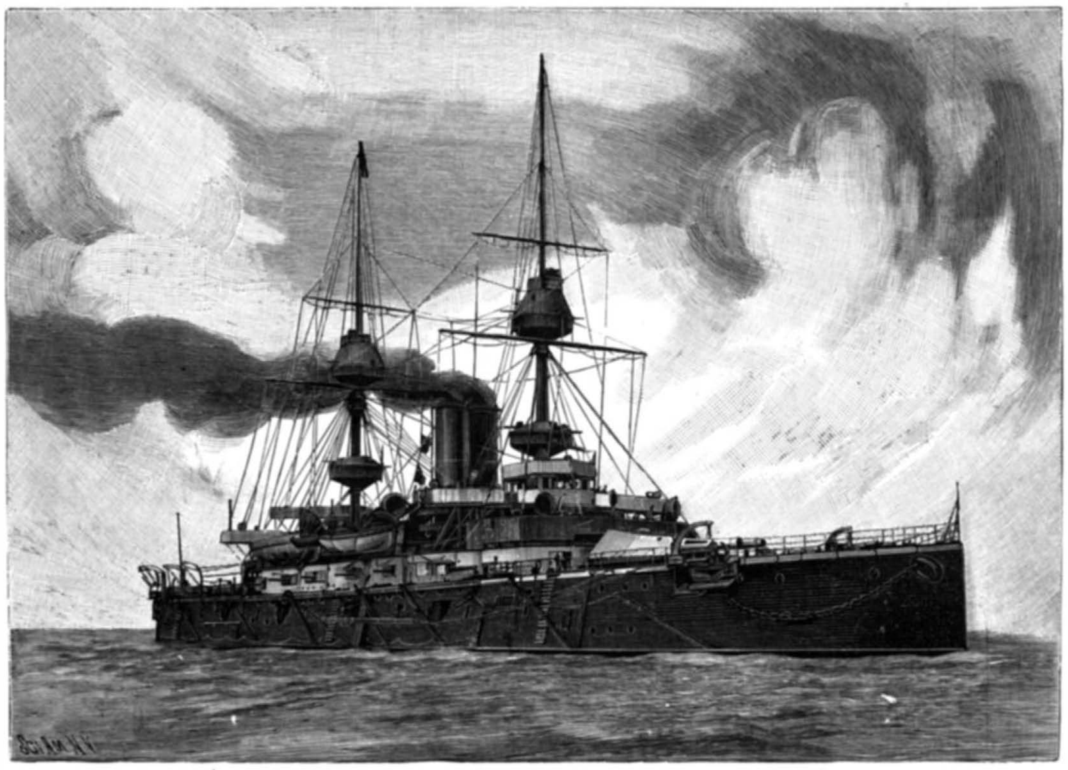
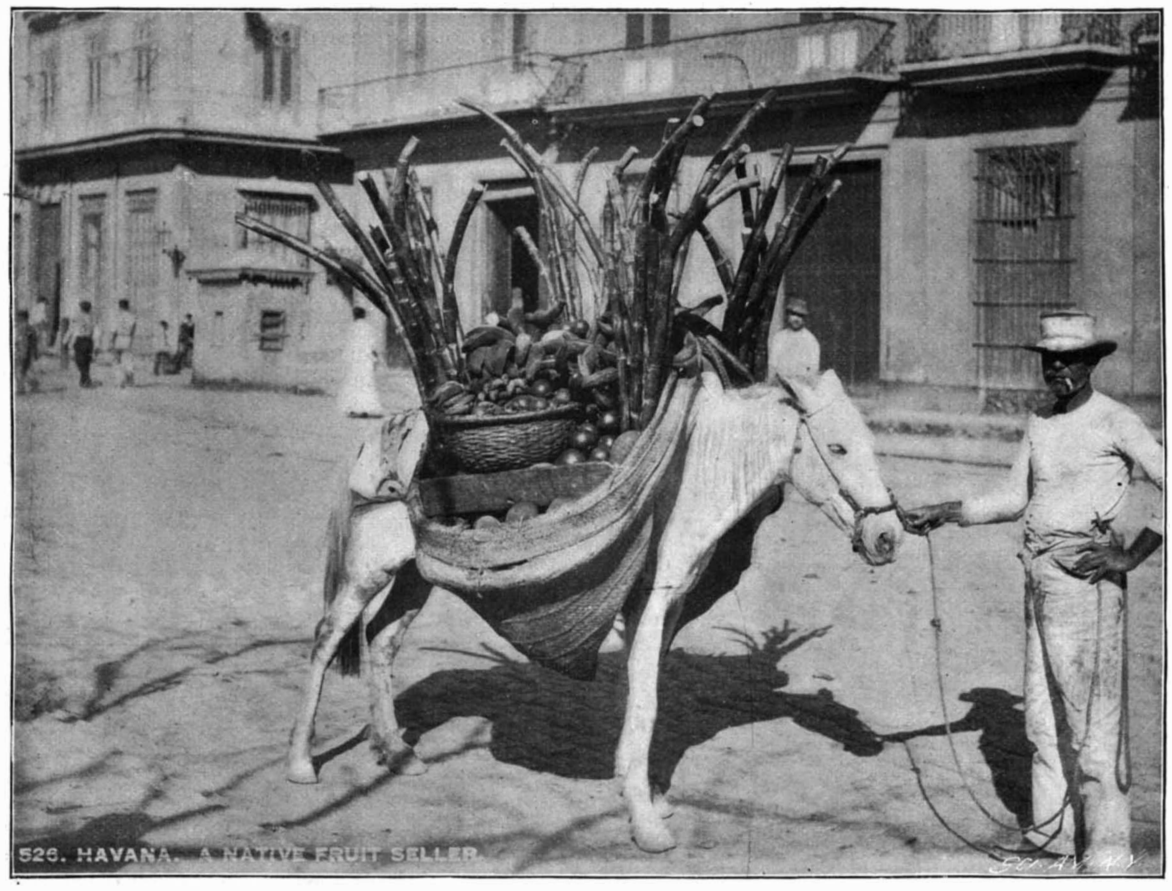


Fig. 3.—GENERAL VIEW OF THE BRITISH ARMORCLAD "VICTORIOUS."

THE BANANA AS THE BASIS OF A NEW INDUSTRY.

The banana grows well in our new possessions in the West Indies, and we have no lack of delicious fruit which has great food value as well. Unfortunately, however, bananas do not stand long sea voyages, and the result is that a considerable market is closed to them. Bananas can, however, be dried and converted into a flour called "bananine," which may prove to be the basis of a very valuable industry. France, understanding the advantages it will be possible to derive from the banana plant, has sent a commission to the United States and Central America for the purpose of studying the banana industry upon the spot, and it has also been suggested by M. Charles Patin, of Belgium, who has investigated the subject, that the banana plant will prove the subject of important agricultural operations in the Congo and destined to produce cheap food for the working classes in Belgium. According to Humboldt the banana has forty-four times more nutritive value than the potato, and according to another authority on dietetics it is twenty-five times more so than good white bread. Since flour can be produced from it at less expense than that obtained from wheat, it is permissible to believe that the products of the banana plant will furnish the working classes of many countries with wholesome, nourishing food at the lowest possible cost. Bananas besides being nutritious are very easy to digest and may be used by the sick, since they are perfectly adapted to weak, delicate stomachs. The article is a direct product of the banana that has reached its complete development. The fruit is peeled by slitting the skin longitudinally and giving it a rotary motion with the hands. The peel having been thus detached the fruit is cut into thin transverse slices which are dried in the sun or in a furnace. It is then only necessary to bray or grind these slices in order to obtain a fine flour therefrom. In Central and South America hand mills are in use for grinding corn for corn bread, and such apparatus are admirably arranged for obtaining from the slices of banana either the banana meal or an impalpable flour made through simple grinding without any passage through a sieve.

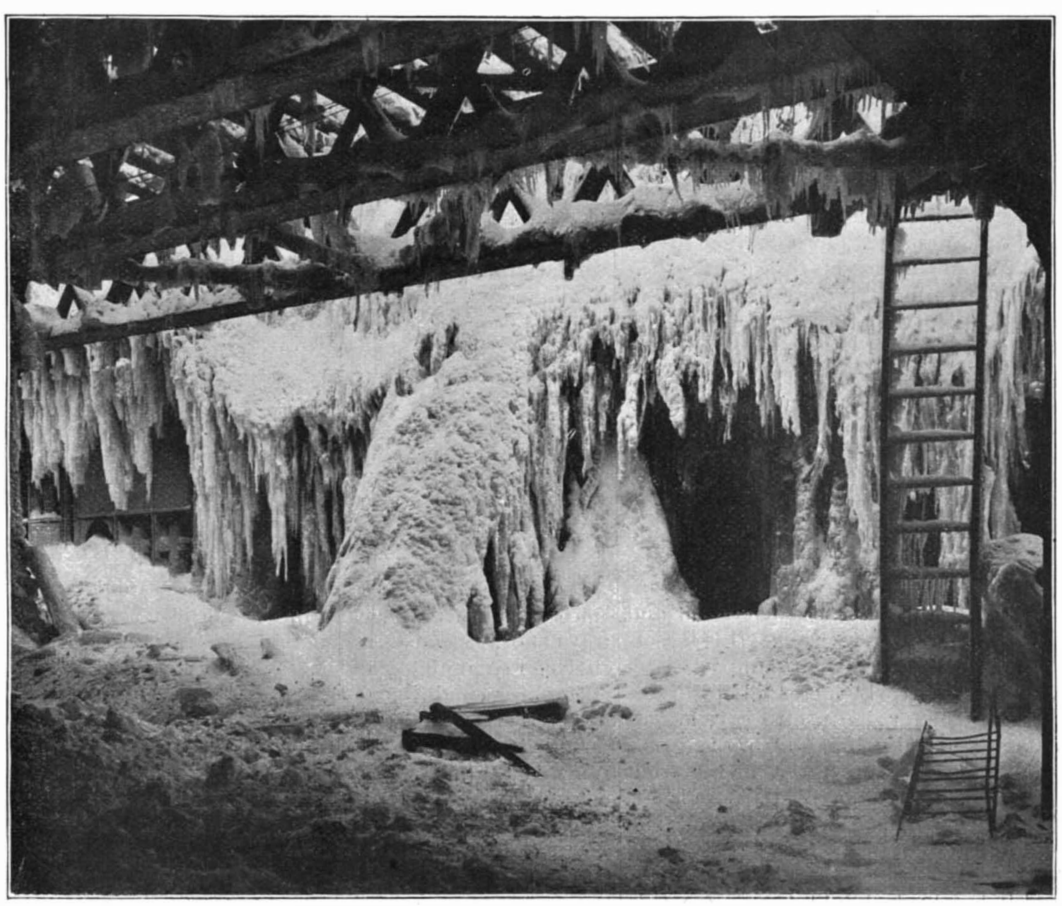
There is another branch of the banana industry; this is the drying of the plantain, which is done in the following manner. The bunches are gathered in quantity as they approach maturity and are suspended in a shed in order to allow the fruit to finish its ripening, say for four or five days, then the fruit is peeled and placed on mats and exposed to the sun. For the first two days the fruit is turned over every two hours, but after this they are turned only once a day. At the end of six or seven days they are sufficiently dry to be put into boxes or baskets like figs, or assorted according to their length, and are then put up in bundles, as is done with vanilla beans. These plantains, packed in boxes and wrapped in tin foil, may be preserved indefinitely. The flavor of the dry banana is somewhat strange at first, but the palate soon adapts itself to the taste.



THE BANANA TRADE IN CUBA.

A REMARKABLE FIRE IN NEW YORK.

There occurred on the morning of Thursday, February 9, a serious fire on South Street, New York city, involving a number of buildings and a loss of property estimated at about three-quarters of a million of dollars. Nearly all the buildings in the block bounded by Front, Moore, South, and Whitehall Streets were practically burned out. As soon as the firemen arrived at the scene they were convinced that it was a fire of great importance, and by ten o'clock all of the apparatus and firemen south of Twenty-fifth Street had been called out, and two fire boats were also hard at work. The fire was fanned by the wintry blast, threatening great damage, and it might have burned two or three blocks in that part of the city if it had not been for the great heroism of the firemen, who succeeded in limiting the conflagration to one block. Some of the buildings were nearly a hundred years old and were perfect fire traps, so that it was a most difficult operation to fight the fire successfully. All the time that the fire burned the water froze as it struck the buildings. The fronts were coated with ice, and from the cornices and window sills hung huge icicles which were frozen into the most fantastic shapes, as the wind had blown the water in process of freezing. The fire escapes on the fronts of the buildings supported icicles which were sometimes the height of an entire story. The ladders which the firemen had placed against the buildings when they first arrived were soon slanting pillars of ice, and there was no resemblance to a ladder left. The spaces between the rungs were frozen solid and the ladder was soon two or three times its original size. Each wire was covered with a coating of ice, and even the elevated structure in Front Street was incrusted with ice and long icicles depended from it. The firemen moved slowly around in the street below, carrying almost their weight in ice, and it is needless to say that they suffered severely, and those in active service had to be relieved at intervals. The fire boats, as the tide fell, were soon left aground, as they had come up very close to South Street, and they soon pumped streams of mud against the South Street buildings, and the muddy water hung down in dark chocolate brown icicles. The flag pole on South Ferry Hotel became so weighted with ice that it bent until the tough ash pole formed almost a semicircle. Firemen very seldom have to work under more discouraging conditions than those which existed at this fire, in which the temperature ranged from zero to two degrees above zero, and the northwest wind blowing at a velocity of thirty-six miles an hour. Our photographs were taken shortly after the fire, and show the front of one of the



FIRE LADDER HIDDEN BY ICE.

FRONT OF A BUILDING INCRUSTED WITH ICICLES.

buildings and also one of the ladders incrusted with icicles.

For the next ten days the firemen were constantly being called out. Over three hundred and fifty alarms were sent in within a few days, and the blizzard of February 13 and 14 made it almost impossible for the engines and other fire apparatus to get through the streets, and in some cases they were stalled. The firemen of New York deserve great credit for their heroic conduct during the severest test to which they have ever been put.

New Uses of Glass.

Early in October, 1898, a paving company of Lyons, France, began laying on the Rue de la République a piece of pavement of ceramo-crystal, ceramic stone, or devitrified glass. During the months of November and December of 1898 and thus far in January, 1899, this pavement has been driven over during all hours of the day and night. It has stood as hard usage as any pavement could be subjected to during that time, and is still in an admirable state of preservation. The glass, or ceramic stone, pavement is laid in the form of blocks, 8 inches square, each block containing sixteen parts in the form of checkers. These blocks are so closely fitted together that water cannot pass between them, and the whole pavement looks like one large checkerboard. Like all thoroughfares in France, the roadbed slopes gently to the walk on each side. Some of the edges of the checkers have been broken off during their three months' service. United States Consul Covert counted some twenty of them that have been slightly chipped on the edges. It is contended that this does not argue against the value of the material as a pavement, and that any kind of stone would have suffered just as much or more in the same time.

Mr. Covert visited the Ceramo-Crystal Manufacturing Company's works at the suburban village of Demi-Lune, about six miles from Lyons. The factories cover nearly 8,000 square yards of ground. Work is now stopped in them while additions are being made to the buildings in the shape of second stories. In the yards are many tons of broken bottles, which the superintendent told me was their "raw material." On the four sides of a large brick smokestack are specimens of ceramo-crystal for buildings and interior decoration, some of the pieces as smooth as highly polished marble, others being rough, like cut stone, and still others having a surface like common brick.

The advantages attributed to this ceramo-crystal by the manufacturers are: As a pavement, it has a greater resistance than stone; it is a poor conductor of heat, and ice will not form upon it readily; dirt will not accumulate upon it as easily as upon stone, and it will not retain microbes; it is more durable than stone and just as cheap. The Central Architectural Society of France made a report recently on this ceramic stone.

This subject is being discussed in the press and is receiving general consideration. An elaborate and exhaustive article in the Revue des Deux Mondes for November treated the question under the heading of "A glass house," the writer asserting that a large house constructed entirely of glass would be an attractive feature of the coming world's exposition in 1900. He said that glass could be used for tubes, pipes, vats, tiles, smokestacks for factories, and for buildings. Double glass walls in a house would admit of the circulation between them of cold or warm air, thus regulating the temperature.

The glass house, or the luminous palace, which it has been decided to build on the grounds of the 1900 exposition, is now being constructed.

The Electric Fuse.

ALTAN D. ADAMS.

Incandescent light and electric power are commonly distributed from what are known as constant pressure circuits.

The distinct feature of constant pressure circuits is that a uniform electric pressure, measured in volts, is maintained between the wires to which lamp and motors are attached.

Now, the fundamental formula governing the flow of electric currents in any conductor, measured in amperes, is that the amperes equal the volts between the ends of any conductor, as a lamp or motor, divided by the electric resistance of the conductor measured in ohms.

Expressed as a fraction, above rule becomes

$$\text{amperes} = \frac{\text{volts}}{\text{ohms}}$$

It is evident from the relation just stated that when the volts remain constant, as in constant pressure circuits, the amperes flowing through any circuit will be very great when the resistance of the circuit in ohms is very small.

For example, the pressure of the ordinary lighting circuit for incandescent lamps is 110 volts; if a conductor is connected to the wires, which has a resistance of 110 ohms, the resisting current in the conductor will be one ampere; if the conductor has resistance of 1 ohm, the current will be 110 amperes; and if the resistance is one-tenth ohm, the resulting current will be 1,100 amperes.

The heat developed in any conductor depends on the number of amperes flowing, and if the amperes are sufficiently increased in any case, the conductor may be made red hot, white hot, or melted.

As the electric current is costly, we cannot afford to let much of it be wasted in heating conductors that produce no useful effect thereby, and we, consequently, proportion the wires of an electric circuit so that their resistance in ohms is small, and there is but little heat produced in them by the electric current.

Lamps and motors form most of the resistance of the electric circuit, and in them most of the heat is produced and work done.

Thus it is common to require electric wiring to be proportioned so as to have from 0·02 to 0·5 of the resistance of the lamps or motors attached to it, so that from 0·95 to 0·98 of the total electric energy is expended in the lamps and motors.

From the above it is evident that, should a lamp or motor with much less than the usual resistance be connected to the wiring, a very large current would flow through the wires, and the loss in them, and, consequently, their temperature, would be greater than intended.

Suppose again that, through some defect in a lamp or motor, or in the devices for connecting same, as switches and sockets, the service wires are connected by a resistance even less than their own.

A current in amperes ten, twenty, or even fifty times as great as intended may now flow through the wiring, heating it red hot or even melting it and setting fire to surrounding materials.

The enormous flow of current, corresponding to the slight resistance, takes place much quicker than one can think of it, and the first notice of any trouble may be the melting of a wire or the blaze of surrounding materials.

Experience has shown the dangers from a rush of electric current through an accidental low resistance connection between the wires to be so great as to absolutely prohibit the use of constant-pressure circuits without some device to interrupt or disconnect the wiring when a low resistance contact is made. The device almost universally employed to disconnect a circuit of electric wiring, when a connection of too low resistance occurs, is the electric fuse.

This fuse usually consists of an alloy of tin, formed into a thin strip and furnished at each end, in all but the smallest sizes, with a copper terminal adapted to go under a screw head. Fuses are proportioned to carry any desired number of amperes, and to melt, thus breaking the connection, a little beyond rated capacity. To confine the hot fuse metal when it melts, the fuse is mounted by clamp contacts on a block of porcelain or slate, and the block provided with a cover of slate, iron, or some incombustible material. Fuse blocks are inserted in the wiring at necessary points, the principle being that every part of the wiring must connect to the source of current through a fuse that will melt and break the connection before enough current flows to heat the wire to a dangerous point. The result of this arrangement is that near the dynamo, connecting it to large wires, carrying the entire current, are placed large fuses, perhaps of hundreds or even thousands of amperes capacity. As the dynamo is left behind, smaller wires are used, branching in various directions, and each connected to the larger wires through a fuse of the proper size, until, finally, a one ampere fuse may be used to protect the flexible card of a single lamp.

On the flow of too great a current, then, through any part of the wiring, the protecting fuse melts, instead of the wire, and disconnects the wiring where the fault exists, without damage. Two distinct advantages are gained through the use of fuses: First, the temperature of the molten metal is reduced from about 1930° Fahr., the fusing point of copper, to 442°, the fusing point of pure tin, or to even less than 200°, if some of the alloys of tin are used; second, the melted metal, instead of dropping at various points across a room, onto inflammable materials, is confined at one point, in an incombustible box, where it can do no harm.

The fuse can be replaced at once, for an insignificant sum, while, to replace a line of wire, would involve time and material expense. Fuses are sometimes supposed to be used for the protection of lamps and motors, but this is incorrect, as their main and primary purpose is to protect the wiring. It is impossible for a fuse to protect incandescent lamps to any definite extent, as, under greatly increased line pressure, the only possible case for the fuse to save lamps, the lamp filaments will usually break before the fuse blows. A fuse may sometimes protect a motor from continuous overload, but its use for this purpose is not very satisfactory. Some persons in charge of electric plants have been known to replace burned-out fuses with wire, nails, or strips of sheet iron; but consideration of the fire risk involved should insure for this practice the strongest condemnation.

A Fossil Plant from the Upper Devonian Strata.

The New York State Museum has recently added to its geologic collections one of the most remarkable fossils that has been unearthed in recent years. It is a fragment of a large fossil plant, about 12 feet in length, with an average cross section of 15 by 11 inches; the short diameter was perpendicular to the plane of bedding, and was probably caused by the pressure of the superincumbent rock. It was collected by J. Nelson Nevius, of the museum staff, from thin bedded, blue sandstone of the Hamilton group, near Monroe, Orange County, N. Y.

Both flattened surfaces show prominent transverse ridges, which evidently were the natural contour of the plant. The rounded surfaces are so badly weathered that it was impossible to collect several feet of them, but where they are in better condition they show that the ridges extend entirely around the trunk. These ridges are irregular in distribution, but average 4½ inches apart, with an amplitude--from the depression to the crest of the ridges—of 1¼ inches.

One end of the specimen includes the stumps of several branches. Before the specimen was removed from its bed, six branches were counted, all branching within a distance of 4 feet along the trunk. They were from 4 to 7 inches in diameter, and were so compressed that it was difficult to trace any particular one for a considerable distance, particularly as the compositions of the fossil and the surrounding rock are very similar. On the side of the excavation opposite that from which the specimen was taken, and 20 feet from the point where the branches diverged, the continuations of two branches were perfectly distinguishable on the face of the rock; the larger of which was 5½ inches in diameter, and of nearly circular cross-section.

The composition of the fossil varies considerably. The greater part of the interior of the trunk varies in no visible particular from the surrounding blue sandstone, and is homogeneous entirely across the trunk. At some places the center of the specimen is a crumbling mass of carbonaceous sand and impure limonite, while in other places the material is almost a quartzite. The latter condition prevails particularly in the branches, which usually show more of a cellular structure than is noticeable in the trunk. Many of the limbs are hollow, and have a tendency to fracture along the rings of growth.

Most of the exterior of the trunk was covered with a thin layer of limonitic, earthy material, having a fibrous appearance which suggested bark; a d many of the troughs between the ridges contained thin layers of soft coal. These materials were so fragile that the greater part of them was unavoidably destroyed in removing the specimen.

Thin sections of the plant, under the microscope, show a more marked cellular structure than is apparent to the eye.

Evidences of plant life abound in the sandstone and shale at this locality. Strata overlying those from which this plant was taken are filled with fragments of what appeared to be sea-weeds. At several localities the black, carbonaceous condition of the shale has led to considerable excavations in a search for coal, which is, of course, fruitless. Small quantities of shale, sufficiently carbonaceous to burn on a grate, have been found.

As no paleobotanist has yet studied this specimen its identity is unknown, but the consensus of opinion of those scientists who have seen it indicates that it is a gigantic sea-weed. It has been suggested that it may be the species described by Dawson as Celluloxylon primaevum, which Penhallow says is an alga, or sea-weed, and belongs to the genus Nematophycus, a synonym for Prototaxities, concerning which there is a difference of opinion as to whether it is a marine or a land form.

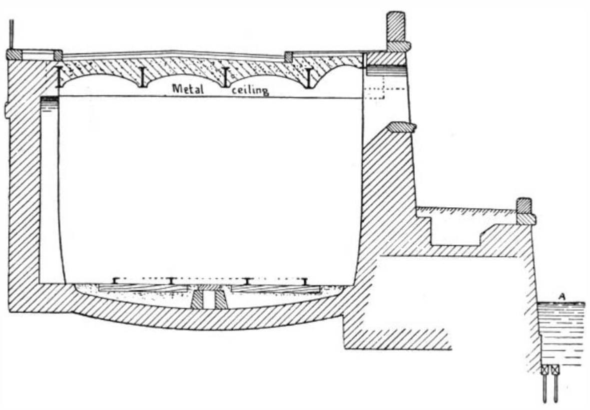
This specimen had lain exposed to the weather for some time, and upon being raised it fell into hundreds of fragments, which Mr. Nevius has reunited, and the entire specimen is nearly ready for exhibition in the museum, where it is already attracting much attention.

Whatever the family and genus of this plant may prove to be, it is extremely rare from the Hamilton group. Large trees were very abundant during the Carboniferous era, and fossils of them are common; but this specimen probably was in exactly its present condition ages before the vegetation of the Carboniferous era began.

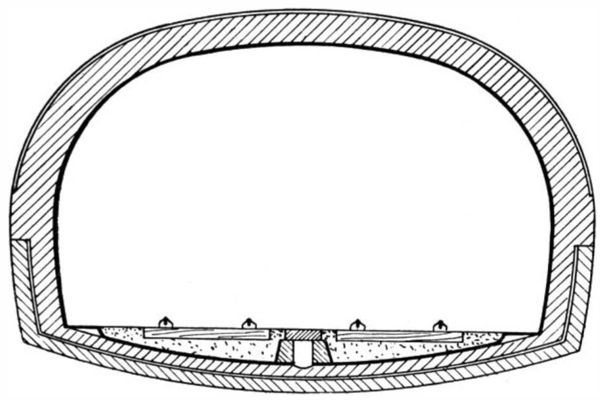
THE time is undoubtedly coming very rapidly when the isolation of the farmer will become mitigated, owing to "neighborhood telephone lines," by means of which they can communicate with each other without reference to the condition of the roads or press of work. A local paper of an inland city in New York State describes an interesting line where the subscribers constructed the line, furnishing the tools and doing the work themselves, the expense for wire, instruments, etc., was equally divided among them, and the cost was only about $14 per share. The line, of course, is free to subscribers, but others can make use of it by the payment of a small fee. At present there are ten subscribers to the line.

NEW RAILWAY ENTERPRISES IN PARIS.

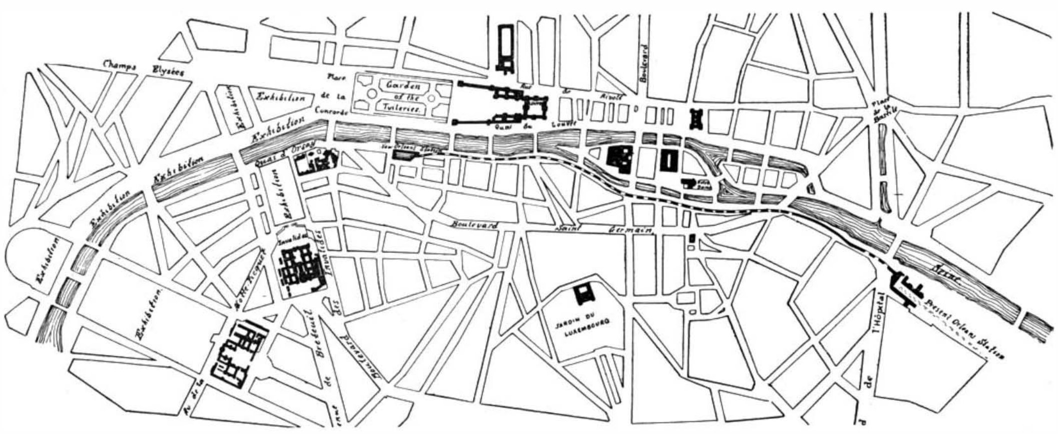
The transportation facilities, always good in connection with former expositions, will be vastly improved during the Exposition of 1900. First, the Paris terminal of the Orleans Railway, now located in the eastern portion of the city, near the Pont d'Austerlitz, is to be brought closer to the business center and to the very gates of the Exposition grounds, on the south bank of the Seine.



1.—CROSS SECTION NEAR PETIT PONT.



2.—CROSS SECTION BETWEEN PONT SULLY AND PETIT PONT.



3.—MAP OF THE EXPOSITION GROUNDS AND EXTENSION OF THE ORLEANS RAILWAY.

Then a small portion of the proposed great belt line, which is to be constructed by the Paris Metropolitan Railway, as a "subterranean boulevard," and somewhat similar to the London underground, will be ready by 1900, which will also land its passengers at the Exposition.

The other railways entering Paris have the terminals of their lines well placed, the terminals of the Compagnie de l'Ouest being especially convenient through the march of city improvements, that known as the Gare Saint Lazare being most central, and the Orleans Railway has suffered therefore from the powerful competition which, naturally, has followed. Such a state of affairs has necessitated the extension of its lines into the heart of Paris, and the establishment of a new terminus, with convenient stations for suburban traffic at other points.

The present terminus is at Place Valhubert, on the east side, not far from the Place de la Bastille, but on the south bank of the Seine. Such an improvement has been contemplated for many years, but the main difficulty in the way was to secure the necessary seven or eight acres of land which would give proper track facilities. Recently, the opportunity to profit through the acquirement of lands, which were to be disposed of on the left bank of the river, and the fact of the approaching Exposition, decided the company that the time for the desired extension had come. A law passed in December, 1897, ceded to the Orleans Railway Company the lands occupied by the former Cour des Comptes and the barracks contiguous, and, the project having been previously planned in all its details, the work began almost immediately upon the company's obtaining possession of the ground, and the ruins of the Cour des Comptes were soon demolished.

In 1892 the company purchased the old Sceaux line, which had its station at Place Denfert, somewhat remote from the city proper. The old road, which was antiquated, was at once reconstructed under its new proprietorship, and it was deemed a necessity to transfer its distant terminus to a point, provisionally secured, near the Jardin du Luxembourg, in order, eventually, to effect a junction with the other lines which would terminate at the new station of the Orleans Railway on Quai d'Orsay, at the gates of the Exposition.

The extension of the Orleans Railway proper, the present terminus of which is at Place Valhubert, will follow the Seine in the direction of Quai St. Bernard up to the approaches of the Quai d'Orsay. Referring to the accompanying map, the present Orleans Railway station will be noticed on the extreme right, from which point it proceeds to the left toward the Exposition Grounds along the Seine, as indicated by heavy dotted lines, and terminates between Pont Royal and Pont Solferino. The unbroken part of the line shows the location and extent of the open cut.

Starting from the old station, the new tracks will be laid below the surface, so that the line will pass under existing structures in the vicinity, and, by a sharp curve, reach the embankment by means of a subway directly under the Place Valhubert. The approaches to the Seine along Quai Saint Bernard are so broad that a strip of 9 meters width can be taken without detriment to public interests. This means that the road will be practically a surface road to a point near the Sully Pont. The Quai being much narrower from this point onward, the tracks have had to be placed at a lower level, the bed of the road being nearly on a plane with the surface of the river, as shown in Fig. 1, which gives a transverse view of the line along the Seine. A metal ceiling supports the causeway, there being no indication above ground of a railway line. Light and air are supplied through frequent apertures placed in the wall, which are apparent in the outline. It is needless to remark that all precautions have been taken against danger of flooding the subway through any pressure that might be caused by a rapid rise in the river. Attention is called to the inverted arch below the bed of the railway in the outline, for which we are indebted to Le Moniteur des Expositions. An acqueduct or drain is also placed between the tracks to carry off the water, and when the natural drainage cannot be depended upon, as in time of inundation from a rise in the Seine, pumps have been provided at intervals.

The construction of the subway between the Sully Pont and the Petit Pont, a few hundred yards west of Notre Dame, is on a different plan, as shown by Fig. 2. In one section, however, a double arch and four tracks are a necessity to allow for the proposed extension of the old Sceaux line, to which reference has already been made. The double arch construction will be formed by running a line of central supports or pillars connected with arches of heavy masonry. The two sections will each have a width of 8 meters instead of 9 meters, the width of the section shown in Fig. 2. The two sections will run side by side for a distance of 500 meters.

In the prosecution of the work of excavation and construction, there has been, practically, no interference with surface traffic, and, in fact, the public have hardly realized what was going on. En passant, New York city might profit from examining into this admirable system in carrying out any future underground rapid transit projects. An attempt of this kind was made in Boston while the great subway was being constructed, but not without complete obstruction to public circulation, at certain points. The work on the Orleans Railway extension is being carried on by the construction of subterranean vaults, the roof soil being held in place by large metal shields which are pushed along, as the work advances, by hydraulic jack screws, the masonry work immediately following, while the debris is removed automatically. The shield used is the same in principle as that invented and used by the late Alfred E. Beach in building a section of road under Broadway, New York, in 1869. This system was followed in the construction of the Clichy Electric Line with perfect success, and it will be employed by the Metropolitan Company when the work of constructing the new belt system is begun.

While the Quai d'Orsay terminus will be the general station of arrival for travelers, there will be a station at Place Saint Michel for the suburban travel, to be open only to passengers without baggage. And that the suburban patron may be subject to as little annoyance as possible, the station levels will be raised to the level of the car floors, a practice common in all English railway stations, and to some extent in those of France. Such a system would, of course, be out of the question in our own country, because the ponderous American railway coach is an entirely different proposition.

The old station of the Place Valhubert, the present terminus, will become a way station, a yard station for the sorting of trains, and the point of departure for troops or other large bodies of men.

The work on the new station at Quai d'Orsay has progressed no further than the foundation, which is a superb piece of engineer work.

4.—PARIS 1900 EXPOSITION TERMINAL, GARE DES INVALIDES, OCTOBER, 1898.

The accompanying illustration shows the state of the work about the first of October, 1898, at which time the photograph was taken. The anticipated expense of the work of extending the Orleans Railway to its terminus is stated to be 40,000,000 francs.

The Paris Metropolitan Railway project is a much greater undertaking. While it is said that a portion of the system will be in operation during the Exposition, the work in its entirety will require a decade for its completion. The portions of the new line that, it is hoped, will be in operation in 1900 are: a section from Place du Danube to the round point of La Villette and another from the Triumphal Arch to the Trocadero, the arch being at the highest point on the Avenue des Champs

Elysées, and the point of intersection of several important avenues.

From a recent number of Nineteen Hundred the following statements are gleaned regarding the different lines which, connecting with each other, will form the "belt" when completed. The first line, subterranean, will run from Parc Vincennes to Porte Dauphine, a distance of nearly seven miles, with eighteen stations. The second line is circular in shape and follows the exterior boulevards. Starting in the immediate vicinity of the Arc de Triomphe, it runs (underground in the Avenue Wagram) to the Boulevards de Courcelles, de Batignolles, de Clichy, de Rochechouart, along which the line is intrenched. It becomes an elevated line on Boulevard de Rouchechouart and continues thus as far as the Rue de Meaux. Thence, it proceeds to La Villette, and on to Belleville and Ménilmontant, and the Lyons Railway terminus, where it connects with line No. 1. It next crosses the Seine, and after reaching Place Denfert-Rochereau and Montparnasse, extends as far as Grenelle, where it crosses the Seine again and passes beneath the Trocadero and Avenue Kleber. Its total length is 14½ miles, with forty-six stations. The third line, subterranean, runs from Porte Maillot to Ménilmontant, 5¾ miles, with sixteen stations.

The fourth line will start at the Porte de Clignancourt and work its way to the Porte d'Orleans, via Boulevards Ornano, Barbes, de Magenta, de Strasbourg and de Sebastopol. As it emerges from Rue du Louvre it will pass under the Seine, and when it reaches the left bank will continue its route via Rue de Rennes and Boulevard Raspail as far as Place Denfert-Rochereau. It then follows Avenue d'Orléans. It is nearly seven miles in length and will have twenty stations.

The fifth line starts from Boulevard de Strasbourg and runs about 2⅛ miles to Boulevard de la Contrescarpe, when it joins line 4, with eight stations. It passes Austerlitz Bridge, Place de la République and Place de la Bastille. The sixth line runs from Cours de Vincennes to Place d'Italie, via Pont de Bercy, about 3¾ miles, with nine stations. A study of the location of the stations shows that the line connects with all prominent points in the city, and it will therefore give Paris an unsurpassed rapid transit system.

The Chemin de Fer de l'Ouest will also be connected with the Exposition, and a new line is being extended from the Gare St. Lazare, running around to the westward of the Exposition grounds, thence passing down the Seine through an uncovered way, below the surface, to the Exposition terminal, the Gare des Invalides. Our illustration gives an idea of the present appearance of the excavation and foundation of this terminal station, the line being known as the "railway des Moulineaux," so called from its first terminal. This will be wholly covered, and at the surface will, in fact, form a part of the new Avenue Alexander II., which crosses the magnificent Alexander III. Bridge, now in process of construction. The station, therefore, will be wholly underground, and directly beneath a central point of that portion of the Exposition grounds which lies nearest the Place de la Concorde and the heart of Paris.

A CIPPUS, a low pillar belonging to the early republican period, has been found in the Forum, at Rome, close to the arch of Severus. The inscription on the cippus indicates that it marked a sacred place.

The Current Supplement.

The current SUPPLEMENT, No. 1209, is a very important issue. The first article is "Progress of Experiments with Kites at the Blue Hill Observatory;" this article illustrates, for the first time, the mechanism employed in flying kites carrying meteorological instruments. It is accompanied by sixteen illustrations showing the kites and all parts of the flying mechanism. It is by Mr. S. P. Fergusson. "Memorandum on the Mineral Resources of the Philippine Islands" is a report by George F. Becker, published in the Mineral Resources of the United States. The usual notes are published and they number some twenty-two. "The Toy Industry of Nuremberg" describes a curious industry carried on in the old German city. "Acetylene," by Vivian B. Lewes, is the fourth lecture and is accompanied by important tables. "Apparatus for Nickel Plating Numerous Small Objects at a Time" describes a form of apparatus concerning which our readers have often inquired. "The Economic Status of Insects as a Class," by Dr. L. O. Howard, is an interesting and scholarly article.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

GEAR-CASE.—CONSTANT A. CHEVALIER and NORBERT G. VASSEUR, Caen, France. The essential characteristic of this novel construction is that the chain-wheel may be fixedly attached to the crank-axle between the ball-bearings, while still maintaining the axle in one piece and fixing on its ends, as usual, the two cranks. There is hence secured a normal traction action of the chain, which prevents all twisting motion and which increases the rigidity of the machine. Particular arrangements for mounting and fitting the ball-bearings, combined with a novel system for lubricating the moving parts, complete the improvements.

Electrical Improvements.

ELECTRIC PRINTING-MACHINE. — GEORGE L. CAMPBELL, Dushore, Pa. This invention provides an improvement in electrically-operated printing-devices, and has for its especial object the printing of bulletins in public places. The improved machine is so constructed that a large number of printing devices may be simultaneously operated from a central point. The machine comprises a frame carrying a sheet of paper with proper mechanism attached thereto for rolling the paper from one roller to another. Mechanism is also provided, by means of which the frame carrying the paper is given a traversing motion in order that a line may be printed upon the paper. The invention furthermore provides a type-wheel, which is rotated by an electromagnet, and a type-impressing mechanism, also operated by an electromagnet, the two magnets being in the same circuit, but the second being being operated only by a current of greater strength than the normal.

Mechanical Devices.

FAN-ATTACHMENT FOR SEWING-MACHINES.—ALPHEUS RUSSEL, Wickliffe, Ky. The attachment comprises essentially a fan carried by a vertical spindle driven by a rubber-tired friction wheel, which may be shifted in and out of engagement with the fly-wheel of the sewing-machine. The fan may be adjusted so that the sewing-machine case may be applied when the fan-attachment is out of operative connection with the sewing-machine.

DRILLING-MACHINE.—ROBERT BINNIE, Bolivar, Pa. The machine is mounted upon tripod, carrying a standard on which the drill frame or carriage slides. The drill-spindle can be reciprocated and rotated, or merely rotated. To impart a reciprocating motion, a spring-pressed cross-head is mounted on the frame, and is pivotally connected by a pitman with a crank-arm, driven by a motor through the medium of gearing. The novel arrangement of springs provided, prevents the transmission of shocks to the cross-head. In order to impart a continuous turning motion to the drill, in addition to the reciprocating motion, the crank-shaft is provided with a worm, by means of which the drill spindle is rotated. When it is desired to dispense with the reciprocating motion, the pitman is disconnected from the cross-head and the crank-shaft, and only a rotary motion is given to the drill-spindle by the worm. An arrangement is provided whereby an intermittent feed motion can be imparted to the frame.

Railway Appliances.

CAR-COUPLING.—JOHN O. STOW, Lawrence, Mich. This car-coupling is so constructed that a brakeman can uncouple the cars while they are in motion. The coupler has a beam with a bifurcated front portion. A hook is pivoted in the bifurcated portion, and a link is connected with the hook. On the coupling, a lever is fulcrumed and connected with the link. When the levers rest on the solid portion of the beams, then the coupling is closed, the arrangement of the parts serving to prevent the hooks from swinging out to release the couplings; but, should one of the levers be drawn aside, the strain on the coupling will throw out one of the hooks, and the couplings will be released.

RAILWAY-SPIKE.—JOHN R. KUNZELMAN, Stillwater, Minn. The spike has a shank and a laterally-projecting wing attached to the shank. The wing has a sharpened lower edge; its lower portion is of greater thickness than the upper portion. A spike thus constructed, when driven into the wood, will be firmly held in place. The spreading action of the rails will not throw the spike out of place, owing to the action of the wings as they engage the wood.

Miscellaneous Inventions.

LOCK. — ADOLPHE MIROT, Manhattan, New York city. The bolt of this lock is thrown by an eccentric, notched throwing-arm provided with a projecting pin concentric with its journal. The key of the lock has a hole in the end of its shank adapted to receive the pin, and has slots in its side communicating with the hole. Dogs, each pivoted by one end in the slot, are spread by engagement with the pin so as to enter the recesses in the throwing-arm. When the bolt is thrown by the eccentric, it is given a half-revolution, the eccentric acting as a lock to prevent the bolt's being forced backwardly by engagement with a knife inserted in the crevice between the door and jamb. It is, hence, impossible to throw the bolt by any other means than a key of the character described.

TEMPORARY-BINDER.—CHARLES T. ROSENTHAL, Batesville, Kan. The binder comprises an upper and a lower member having hinged connection. The members are provided with means for holding leaves between them. Guide-plates are secured to the inner faces of the members, extend in opposite directions and are placed out of vertical alinement. Each guide consists of a body and of a hook-section carried by the body. A locking-plate is held to slide between the hook and the body-sections of the guides, and is provided with recesses arranged to register with the hook portions of the guides. Each section is capable of independent use. By reason of the peculiar construction described, the leaves contained in a section may be removed without disturbing those of an adjoining section.

GATE.—CHARLES RICE, Durham, Ill. This gate is provided with latch-devices operated by levers projected to each side of the gateway, so that the gate can be opened or closed by a horseback rider or by a person seated in a carriage, without the necessity of dismounting or descending to the ground. The novel features of the invention are found in a construction whereby the end of the gate is adapted to strike against the abutment-posts in such a manner as to relieve the latch from undue shock and also permit a quick operation thereof as the gate moves to its open or closed position.

VEHICLE TRACK. — SANFORD B. DICKINSON, Corning, N. Y. This improved vehicle-track is adapted especially for wagons and bicycles, and is designed to render more easy the passage of such vehicles over streets and roads. The track comprises a series of supported columns provided at their upper ends with vertical slots in alinement with one another. The track itself consists of a length of sheet metal provided with a marginal flange at each side, and with a central flange between the marginal flanges. All of the flanges are projected downwardly. The marginal flanges are located, one on each side of the columne; while the central flange is projected into the slots of the columns.

SNAP-HOOK. — CHARLES M. BEARD, Elroy, Wis. The body of this hook is provided at one end with a hook and at the other end with a loop. A tongue is pivotally mounted on the body adjacent to the loop and has its free end adapted to engage with the hook at the limit of the outward movement of the tongue. The free portion of the tongue is formed with a head comprising two oppositely-extending shoulders which are engaged by two lugs formed on the body of the snap-hook. A hook thus constructed can be readily opened with a gloved or ungloved hand.

WINDMILL.—ALBERT J. SMALLEY, El Reno, Oklahoma Territory. The wind-wheel of this mill comprises spiders or end frames having radial arms to which blades are attached. The spiders are connected with a shaft, to one end of which a crank is secured for operating the pumping-rod. A boxing extends around the tower to cut off the lower portion of the wheel from wind force. Above the boxing, the tower is wholly open at opposite sides. The openings are designed to be closed automatically by doors controlled by the governor-shaft. On the outer end of the governor-rod a vane is mounted to swing. The vane operates to cause the governor-rod to draw the doors upwardly as the velocity of the wind increases, in order to cut off a portion of the wind. When the wind becomes exceedingly violent, the doors will rise to the top of the towers and entirely cut off the wind. The mill is thus enabled to run at a uniform speed, no matter what the velocity of the wind may be.

COMPASS. — LUDWIG RELLSTAB, Kiel, Germany. This compass is designed especially for use on shipboard, and is constructed so that the deflection of the compass occasioned by the influence of adjacent magnetic bodies will be automatically corrected. This end is attained by mounting on the compass-card an electromagnet, which, upon the deflection of the card carrying the main and auxiliary needles, is energized so that a counter influence will be exercised and the card returned to its proper position.

ROADWAY.—JOHN W. MALTBY, Gates, N. Y. In the construction of a roadway according to this invention, metal plates are so placed between receivers adapted to contain concrete, that the road-bed may be made in sections. The sections of the roadway are completed by introducing asphalt or concrete into the receivers and between the receivers; or a suitable plastic foundation may be laid in the receivers, in which blocks of granite or other material may be introduced, if preferred.

APPARATUS FOR DISTILLING PETROLEUM.—FREDERICK W. MANN, Franklin, Pa. In the fractional distillation of petroleum, a residuum of heavy hydrocarbons is left, which has but little market value. To decrease the proportion of this residuum a process known as the "cracking" process is employed, which submits the hydrocarbon vapors to the action of heat in order to break up the molecules into other arrangements, resulting in the production of a larger proportion of valuable compounds. The inventor of the present process has discovered that the results produced by the "cracking" process may be improved upon, by subjecting the hydrocarbon vapors to the simultaneous action of heat and pressure.

IRONING-BOARD. — EDWARD G. HUMMELL, Lancaster, N. Y. The present invention is a combination ironing-board, wash-bench, and portable shelf. There is a table to which a leg is pivoted; and an extensible brace consisting of sliding sections is connected with the table and leg. One of the sections is tubular and has its free end bent laterally; while the other section is toothed and passes into the tubular section. A locking-member is fitted to slide in the lateral extension of the tubular section and to engage the toothed section of the brace.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

AZIMUTH AND ALTITUDE ASTRONOMICAL CHARTS. Cambridge, Mass., and 29 Hamilton Terrace, One Hundred and Forty-fourth Street, New York City: F. R. Coar. Four sheets and explanatory pamphlet. Price $1.75.

Each star sheet is centered on the visible horizon for 40° north latitude and for the middle of its right ascension or hour angle at the middle of the three month period of each star sheet, so that there will be but little variation of the stars from the zenith point for the three months designated on each sheet. The outlines of the constellations are given, with the positions and magnitude of the principal stars to be seen by the naked eye. The star sheets and pamphlet are very complete compendiums for indicating star positions for amateurs and students.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7603) H. E. asks the meaning of the familiar expression, "Too cold to snow." A. "Too cold to snow" means that it is not probable that there will be snow till the weather becomes warmer. It is never too cold to snow in an absolute sense. Snow falls at the North Pole in great quantities, but during a period of great cold the air over large areas is very uniform in temperature and pressure, and also in dryness. The result of all this is a continuance of good weather until, on the approach of a "low" area, the wind hauls into the south, the temperature rises, and ere long snow begins to fall. The warm air from the south on being chilled cannot contain as much water vapor as before, and the excess freezes and falls as snow.

(7604) F. H. writes: 1. I intend to construct a 50 watt dynamo for the schoolroom. Which should I prefer—50 volts 1 ampere, or ½ ampere at 100 volts? I would like to show the arc if possible, besides other experiments. A. There is little difference between a dynamo giving 1 ampere at 50 volts and one giving ½ ampere at 100 volts. Fifty volts are all you can use in one arc, but one ampere will not give a strong arc. A dynamo giving 5 amperes at 10 volts, or 10 amperes at 5 volts, would be more serviceable for experiments in schoolroom. 2. Is there any book for amateurs in the line of Bottone's "Instrument Making for Amateurs," dealing with the construction of apparatus for different branches of physics? A. Hopkins' "Experimental Science," price $4, is the book you need. A good book to go with it is Weinhold's "Experimental Physics."

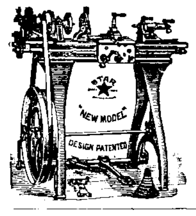
Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.



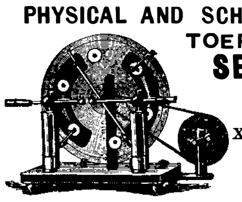
Star ★ Lathes Foot power Screw... ...cutting Automatic Cross feed

9 and 11-inch Swing.
New and Original Features
Send for Catalogue B.
Seneca Falls Mfg. Company,
695 Water St., Seneca Falls, N.Y.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

PHYSICAL AND SCHOOL APPARATUS

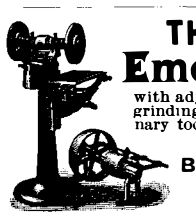


TOEPLER HOLTZ
SELF CHARGING MACHINE
For School, College or X Ray work.
☞ *Circular free.*
E. S. RITCHIE & SONS,
Brookline, Mass.

The Coburn Patent Trolley Track

Store Ladders.

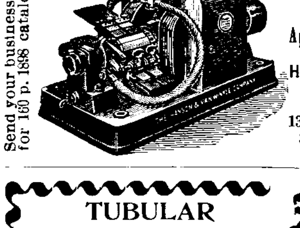
A PAIR OF STAIRS ALL ALONG THE LINE OF SHELVES.
☞ *Send for Book.*
The Coburn Trolley Track Mfg. Co.
HOLYOKE, MASS.



THE WATERBURY
Emery Grinder,

with adjustable table, for flat surface grinding and finishing, and for ordinary tool grinding.
☞ *Send for Circulars.*
BLAKE & JOHNSON,
P. O. BOX 7,
WATERBURY, CONN.

Weighs 6 oz.
Universal Bevel Protractor.
Blade 7 in. long, may be slipped back and forth full length or turned at any angle around the circle. One side of the tool is flat.
☞ *Catalogue of Fine Tools free.*
Price $5.00
THE L. S. STARRETT CO.
Box 13, **Athol, Mass., U. S. A.**



Send your business card for 160 p. 1898 catalogue.

NICKEL
AND
Electro-Plating
Apparatus and Material.
THE
Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

TUBULAR
DRIVING LAMP.

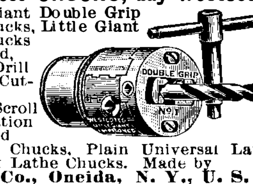
IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine head-light.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).

R. E. DIETZ CO., 60 Laight Street, New York.
Mention this paper and get special discount.
—ESTABLISHED 1840.—

The Forbes Patent Die Stocks for Hand Power

Ten inch pipe cut off and threaded by one man with ease.
☞ *Send for Catalogue.*
CURTIS & CURTIS,
6 Garden St., Bridgeport, Conn.
No. 56 Hand Machine
Range 2⅛ to 6 inch

If you want the best CHUCKS, buy Westcott's



Little Giant Double Grip Drill Chucks, Little Giant Drill Chucks Improved, Oneida Drill Chucks, Cutting-off Chucks, Scroll Combination Lathe Chucks, Geared Combination Lathe Chucks, Plain Universal Lathe Chucks, Independent Lathe Chucks. Made by **Westcott Chuck Co., Oneida, N. Y., U. S. A.**
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

ROCK DRILLS
AIR COMPRESSORS
SIMPLEST, MOST EFFICIENT and DURABLE.
RAND DRILL CO.
Send for Catalogue 100 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

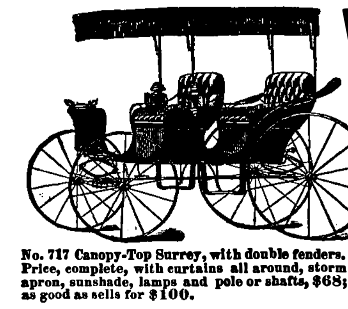
FEBRUARY 21, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising, means for, Hawkins & Wright...... 620,033
Air from tins, bottles, jars, etc., means for excluding, A. Dunhill...... 619,878
Ankle joint, artificial, C. H. Doerflinger et al...... 619,731
Asphalt, treating bagging for, R. D. Upham...... 619,810
Awning, adjustable, W. E. Hettrick...... 619,957
Axle, divided crank, G. P. Jones...... 620,075
Axle, vehicle, Copass & Biles...... 619,822
Bag filling apparatus, W. E. Nickerson...... 619,834
Barrel head, J. Kane...... 620,038
Bath tub leg fastener, A. Ow...... 619,988
Bathing apparatus, V. M. George...... 619,953
Bearing, axle, C. Faulkner...... 619,946
Belting, machine, H. T. Reuter...... 619,908
Bicycle brake and clutch, L. Conwell...... 619,721
Bicycle driving gear, W. J. Thompson...... 620,003
Bicycle folding rack, G. T. Murray...... 619,775
Bicycle gearing, W. A. Tickner...... 620,060
Bicycle saddle, R. Lewis, Jr...... 619,768
Bicycle saddle spring, S. A. Bailey...... 620,012
Bicycles, combined support and mud guard for, H. Sennstrom...... 619,796
Bicycles, etc., luggage carrier for, H. Tanner...... 619,913
Biscuits, cakes, etc., cutter for, W. A. Hooks...... 619,749
Bobbins, equalizing driving device for, J. E. Tynan...... 619,806
Bolt or pipe extractor, A. S. Utt...... 620,062
Book cover blank cutting die, C. L'Enfant...... 619,967
Border maker and ridger, F. W. Reimold...... 619,789
Boring apparatus for deep borings, A. Raky...... 619,907
Boring machine, cylinder, G. W. Montgomery...... 619,830
Bottle, antirefilling, F. S. Elwell...... 619,945
Bottle, non-refillable, L. Giacomini...... 619,741
Bottle, non-refillable, J. L. Kendrick...... 620,076
Bottle, non-refillable, N. Lanser...... 619,966
Box fastener, Robinson & Downard...... 620,055
Box fastener, J. Unser...... 619,809
Box lid support, W. S. Hawes...... 619,826
Brush attachment, J. A. Martin...... 619,975
Brush, fly, I. W. Niles...... 619,781
Brush holder, S. H. Cochrun...... 619,941
Burner. See Gas burner.
Burnishing machine, M. J. O'Keefe...... 619,987
Button, cuff, J. L. Briggs...... 619,932
Camera, E. O. Schaaf...... 619,792
Camera, multiplying, J. W. Jenkins...... 620,036
Can cap or cover, S. S. Martin...... 619,976
Candlestick and fuse implement, combined miner's, J. F. Layes...... 619,765
Canned tamales, J. Bunzl...... 620,084
Canopy support, J. C. Woodward...... 620,008
Car brake, automatic, Buchel & McGloin...... 619,933
Car brake shoe, railway, Power & Devore...... 619,990
Car coupling, T. Fildes...... 619,881
Car coupling hook, W. P. Hughes...... 619,827
Car door fastening, A. W. Prescott...... 619,991
Car fastener, stock, J. C. Pearson...... 620,049
Car fender, A. H. Etheridge...... 619,738
Car fender, G. Rischmuller...... 619,841
Car fender, street, Rittenhouse & Phelps...... 619,790
Car starter, F. B. Nims...... 619,986
Car step, H. E. Spink...... 619,800
Car ventilator, L. W. Canady...... 619,718
Cars, bellows fold coupling for vestibule, E. L. & E. L. Perry, Jr...... 619,785
Cars, locomotives, etc., fender for, V. Pfaff...... 619,989
Card holder, playing, C. Hustedt, Jr...... 619,960
Carding engine, revolving flat, W. V. Threlfall...... 620,089
Carline, H. W. Gays...... 619,952
Carpet stretcher, E. C. Walden...... 620,065
Cartridge shell cleaner, C. W. Phillips...... 619,906
Cartridge shells, machine for making, W. B. Place...... 619,787
Case. See Medicine case.
Cash register, A. Latham......619,763, 619,764
Cash register, pocket, E. C. Akers...... 619,924
Casting apparatus, R. W. Davies...... 620,020
Chains, cutting link for mortise cutting, E. S. Higgins...... 619,888
Chair. See Self leveling chair.
Chair supporting device, E. P. Ray...... 620,078
Change maker and indicator, J. Pfeifer...... 619,786
Cheese cutting device, A. L. Nichols...... 619,905
Chill, contractile, J. N. Barr...... 619,926
Churn, B. F. Emery...... 619,739
Churn, W. E. Vernon...... 619,811
Cigarette packet, match provided, F. L. Cook...... 619,866
Clamp, F. J. Cronin...... 619,869
Clock, secondary electric, J. O. Lyman...... 619,771
Clothes drier, J. D. Morrissey...... 619,902
Clothes pin, E. O. Lunt...... 619,971
Coffee pulping machine, R. T. Rickard...... 620,053
Coffin, H. W. Booth...... 619,929
Combination lock, H. L. Clarke...... 619,940
Compass, beam, Weishampel & Duncan...... 619,813
Composition of matter, R. W. Hochstetter...... 619,889
Conveyer, freight, M. Butler...... 620,015
Corset, J. M. Van Orden...... 619,851
Coupling. See Car coupling. Railway coupling.
Crane, traveling, A. B. Tenney...... 620,088
Crate, berry, G. I. Feit...... 620,024
Creaming can, H. S. Hunt...... 619,753
Crib attachment, F. M. Cobb...... 620,069
Crucible furnace, Marsh & Millett...... 619,973
Cultivator, Morrison & Kregnes...... 620,046
Damper regulator, L. Reaser...... 619,993
Dental cabinet, C. S. Bigelow...... 619,928
Dental plugger, automatic, H. McLaren...... 619,832
Door fastener and burglar alarm, L. Saladin...... 619,997
Door, sliding, J. Schlutter...... 619,794
Dredging vessel dumping door, J. Edwards...... 619,737
Drilling machine, S. H. Harrington...... 619,955
Dust from various materials, device for separating, W. Sutcliffe...... 619,912
Dye and making same, blue, K. Heumann...... 619,884
Edge setting and burnishing machine, A. H. Kline...... 619,963
Egg holder for boiling eggs, H. J. Marks...... 620,044
Electric circuit closer, J. J. Busenbenz...... 619,936
Electric heater, L. Casper...... 620,086
Electric machine, dynamo, T. B. Kinraide...... 619,761
Electric meter, T. Duncan......619,733, 619,734
Electric meter, multiple rate, T. Duncan...... 619,735
Electric switch, A. H. Miller...... 619,900
Electrical apparatus, T. B. Kinraide...... 619,760
Electrical controlling apparatus, O. H. & A. F. Pieper (reissue)...... 11,718
Elevator. See Straw elevator.
Elevator vent device, pneumatic, J. K. Sharpe, Jr...... 619,844
Excavating machine, J. Stubbs...... 619,802
Extractor. See Bolt or pipe extractor.
Fence machine, J. M. Keith...... 619,758
Fender. See Car fender. Hearth fender.
Fermentation of materials which have been rendered aseptic, J. Effront...... 620,022
Filter, Z. F. Potter......619,838, 619,839
Filter strainer, J. W. Hyatt...... 619,755
Filter, water, J. Ellis...... 619,944
Fireproof ceiling, L. W. G. Lilienthal...... 619,769
Fish trap, M. Zack...... 619,819
Flowers, device for crimping artificial, J. De Grandmont...... 620,029
Fly escape, window, A. J. Collar...... 619,865
Foot covering, P. Petchaft...... 619,837
Forceps, druggist's bottle, P. H. Flynn...... 619,949
Fruit grader, Morley & Patrick...... 620,045
Fuel, artificial, J. T. Davis......619,728, 619,729
Funnel, J. B. Paradis...... 619,836
Furnace. See Crucible furnace. Gas furnace.
Furnace, E. M. Washburn...... 619,852
Furnace door, G. W. Wolf...... 619,817
Game, coin freed, E. G. Matthewson...... 619,897
Garment facing, A. C. McLaughlin...... 619,984
Gas burner, acetylene, E. H. J. Schulke...... 619,843
Gas engine, P. Murray...... 619,776
Gas engine, A. A. Vansickle...... 620,080
Gas furnace, C. W. Rice...... 620,052
Gas generator, acetylene, D. N. Long...... 619,970
Gas generator, acetylene, F. O. McQueen...... 619,833
Gas generator, acetylene, J. F. Van Dervort...... 620,064
Gas generator, acetylene, T. F. Williams...... 619,814
Gas pipe joints and ends, locking clip for, F. J. Schreiner...... 619,795
Gasket, steam packing, E. L. Perry...... 619,784
Gate, J. S. Lewis...... 619,766
Gate can, R. C. Hopkins...... 619,750
Gearing, R. W. Jamieson...... 620,074
Gearing, J. F. Morgan...... 619,774
Germ of insect exterminator, E. W. Terrell...... 620,079
Gin saw teeth, machine for cleaning and straightening, G. P. Roberts...... 619,842
Glass or metal pipes, shrinking core for moulding, G. G. Winans...... 619 815

(Continued on page 142)



No. 717 Canopy-Top Surrey, with double fenders. Price, complete, with curtains all around, storm apron, sunshade, lamps and pole or shafts, $68; as good as sells for $100.

WHY NOT SAVE IT?

When it comes to buying a vehicle of any kind you may just as well save all the money in the transaction above the manufacturer's price. No need to pay added commissions and expenses of traveling salesmen, middlemen, dealers, agents, etc.

WE HAVE NO AGENTS

but sell direct from our factory at wholesale prices. We are the largest manufacturers of vehicles and harness in the world selling to the consumer exclusively.

IN VEHICLES WE MAKE

Rockaways, Surreys, Traps, Phaetons, Stanhopes, Driving Wagons, Top Buggies, Open and Top Road Wagons, Spring Wagons, Delivery Wagons, Milk Wagons and Wagonettes. In harness we make either single double harness suitable to all the above vehicles and heavy team use.

No. 77—Single Surrey harness $16, good as sells for $25

SEND FOR LARGE FREE CATALOGUE.

ELKHART HARNESS AND CARRIAGE MANFG. CO. W. B. Pratt, Sec'y. **ELKHART, INDIANA.**

What the great soloists of Sousa's Band think of the Gram-o-phone.

"We consider the Gram-o-phone the only Talking Machine which perfectly reproduces the true tone qualities of our respective instruments."

[Signed]
ARTHUR PRYOR, Trombone Soloist.
HENRY HIGGINS, Cornet Soloist.
JEAN MOEREMANS, Saxophone Soloist.
SIMONE MANTIA, Euphonium Soloist.
JOSEPH NORRITO, Clarionet Soloist.

The **Gram-o-phone** brings within the family circle actual reproductions of a hundred celebrated artists, and is used by the wealthy and refined for high-class home entertainment

Send for particulars, and how actual subscribers to the SCIENTIFIC AMERICAN may purchase this wonderful instrument on the installment plan.

THE NATIONAL GRAM-O-PHONE CO.
874 Broadway, - - NEW YORK.

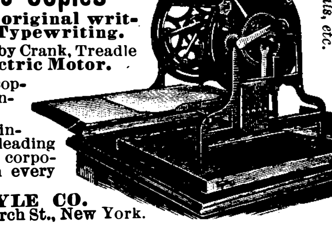
SEED DUE BILL FREE

To get new customers to test my seeds I will mail my handsome **catalogue for 1899,** lithographed and beautifully illustrated, and a **10c. Due Bill,** good for 10c. worth of seeds for trial, **absolutely free.** It is full of bargains. All the **Best Seeds, Bulbs, Plants, Roses, new Fruits, Farm Seeds, Potatoes, etc.,** at lowest prices. **Ten Great Novelties** offered without names. I will pay **$50. FOR A NAME** for each. Don't buy your stock until you see this new catalogue. Several varieties shown in colors. Great inducements for orders this year. **You will be surprised** at my bargain offers. Send your address on Postal to-day. Tell your friends to send too. Old customers will receive a copy.
F. B. MILLS, Seedsman, Box 187, Rose Hill, N. Y.

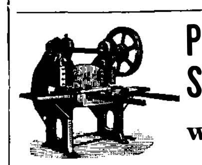
BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT **1123.** Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for 1897 catalogue.

Rotary Neostyle

5,000 Copies
from **one original writing** or **Typewriting.**
Operated by Crank, Treadle or **Electric Motor.**
Speed 70 copies per minute.
Used and indorsed by leading firms and corporations in every city.
NEOSTYLE CO.
98-102 Church St., New York.

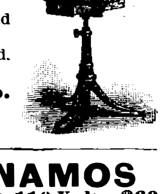


Send for Catalogue, Testimonials, etc.



PRESSES, DIES and SPECIAL MACHINERY
For Sheet Metal Workers.
WEST MFG. COMPANY,
Buffalo, N. Y., U. S. A.

TWO UP TO DATE
DRAWING TABLES
Size of Top 20 x 28.
Adjustable to required height and angle. Shipped knocked down.
Price $6.00 and $8.00. Freight prepaid.
☞ *Send for circular.*
Adjustable Drawing Table Co.
Powers Opera House Block,
Grand Rapids, Mich.

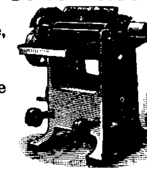


DYNAMOS

15 Light, 110 Volt, $60
25 " " " 85
50 " " " 115

Price includes Field Rheostat, Sliding Base, Belt Tightener and Pulley. These Dynamos are of the best on the market and are fully guaranteed for one year. Correspondence solicited. Address
ROTH BROS. & CO., Mfrs.
34 Market St., Chicago, Ill.

WOODWORKING MACHINERY.
For Planing Mills, Carpenters, Builders, Furniture, Chair, Vehicle, Wheel and Spoke Makers, etc.
☞ *Correspondence Solicited.*
Illustrated 312-page Catalogue free to manufacturers and foremen.
THE EGAN CO.
327 to 347 West Front Street,
CINCINNATI, OHIO.



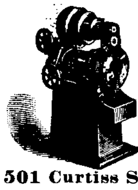
REPAIR BICYCLES FOR A LIVING!

EASY WAY TO MAKE A GOOD LIVING.

Bellows, Blowpipe, Vise, Files, Spokes, Pliers, Spoke Threader, Caliper, Cones, Repair Parts. Complete Outfits. Send 25 cents, in U. S. stamps, for illustrated treatise, "HOW TO REPAIR BICYCLES," by competent authorities, and a fully illustrated catalogue embracing thousands of bargains in Tools, Fittings, and Repair Parts.

THE FRASSE COMPANY, 21 Warren Street, NEW YORK

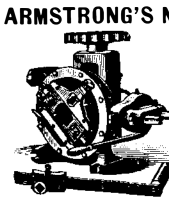
For Heavy Continuous Work



every machine shop will commend our **Power Pipe Threading and Cutting Machine.** Cones are central over machine, equalizing the weight. Within the cones are compound gears giving six changes of speed. Gears require no extra space, and are protected from dust or accident. Chasers can be opened, threaded pipe removed, another inserted and cut without stopping machine. ☞ *Send for Catalogue.*
THE MERRELL MFG. CO.
501 Curtiss Street, TOLEDO, OHIO.

PHOTOGRAPHY IN COLORS—FORMULAS for producing photographs in colors by the Chassagne process. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **1114** and **1125.** Price 10 cents each, by mail, from this office and from all newsdealers.

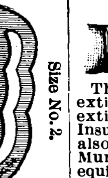
ARMSTRONG'S No. 0 THREADING MACHINE



Can be attached to bench or post. Designed for threading the smaller sizes of pipe, iron or brass, also bolts. Has two speeds, one for pipe ⅛ to 1 inch; the other for pipe 1¼ to 2 inches, inclusive. Uses the regular Armstrong adjustable dies. Other attractive features. Send for particulars. **The Armstrong Mfg. Co.,** 139 Centre Street, New York. Bridgeport, Conn.

THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**



Size No. 2.

SCREW-CUTTING DIE HEADS
SELF-OPENING and ADJUSTABLE.

The best die head on the market. Some advantages over "others," viz.: They are smaller, stronger, more compact, have no levers to spring, cannot be clogged by chips, are always reliable, and the prices are right. ☞ *Send for descriptive circular "S. A."* Our die heads are furnished in sizes suitable for cutting threads from No. 17 wire gauge to 6 inches diameter inclusive.
GEOMETRIC DRILL CO., WESTVILLE, CT.
EUROPEAN AGENTS: CHAS. CHURCHILL & CO., London, England. WHITE, CHILD & BENEY, Vienna, Austria.

A HOUSEHOLD PROBLEM SOLVED
by covering Furnace and Heater Pipes with

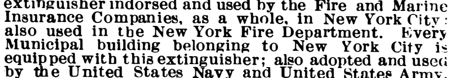
GAST'S ASBESTOS AIR CELL COVERING
Estimates and samples can be had for the asking.
New York Fire Proof Covering Co.
23 Dey Street, New York.

INGERSOLL WHEELS. $2.00 DOWN.
Sold only to riders; no Dealers' Profits. Highest Grade, **$25.** Broadest Guarantee. Large Mail Order Catalogue of Bicycles and Sundries FREE. R. H. INGERSOLL & BRO., Dept. 147, 67 Cortlandt St., N. Y. C.

SECTORLESS WIMSHURST MACHINE.—This article gives directions for making. 4 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT **1131.** Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

The Little Giant Fire Extinguisher.

Price $2 each. West of the Mississippi, $2.50 each.
(To unseal, twist the handle.)



The **Little Giant** gets better results on fire than extinguishers costing from $15 to $25. The only fire extinguisher indorsed and used by the Fire and Marine Insurance Companies, as a whole, in New York City: also used in the New York Fire Department. Every Municipal building belonging to New York City is equipped with this extinguisher; also adopted and used by the United States Navy and United States Army. Light, cheap, simple, durable and efficient.

Have extinguished hundreds of accidental fires in the past two years. Never fails to put out fire. Needs no care or attention. Any child can work it. No acids are used and no gases are generated until the solution comes in contact with fire, thus preventing explosion. This cannot be said of any other fire extinguisher in the world. ☞ **AGENTS WANTED.**

☞ *Books and pamphlets sent FREE on application. Our book of 50 pages describing accidental fires extinguished, you will find most interesting.*

We guarantee every extinguisher, and when used at accidental fires they are replaced with new ones by giving us a testimonial of the fire acknowledged before a notary public.

The Little Giant Fire Extinguisher Co., 22 Liberty St. N.Y.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1182.** Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or by any bookseller or newsdealer.

Gold from river beds, apparatus for collecting, J. T. Davis 619,727
Gopher trap, C. W. Roth 619,946
Grain, etc., apparatus for elevating, R. Folsche 619,882
Grain trimming device, T. J. Skillin 619,799
Graphophone, D. S. Williams 619,916
Gravity motor, oscillating, W. L. Harvey 620,032
Grinding mill, H. Kelly 619,892
Gyrator, S. A. Oyer 620,048
Hair crimper, M. E. Thompson 619,805
Hame attachment, J. Goeller 619,825
Hame fastener, A. Ward 619,812
Hat conformator, C. J. Dietrich 619,874
Hay press, G. F. Biggs 619,858
Hay press, J. Cruickshank 619,725
Hearth fender, sheet metal, F. G. Caldwell 619,863
Hedge puller or stump extractor, O. H. Lewis 619,767
Heel grinding or polishing tool, L. T. Adams 619,921
Hoists or lifts, locking apparatus for doors of, J. C. Etchells 619,879
Horse toe weight, Fehr & Lovatt 619,947
Horseshoe, W. S. Hitch 619,745
Horseshoe calk, C. Richter 619,995
Horseshoe pad, D. Cruise 620,019
Incandescent mantle and making same, S. Cohn 620,017
Indigo and making it, dimethyl, K. Heumann 619,883
Induction coil, M. E. Fuld 620,027
Injector, Hogue & Jack 619,961
Insulating caster, H. S. Lee 619,896
Insulator, rail, C. B. Martin 619,974
Insulator tie wire or clasp, F. W. Wentworth 619,915
Ironing machine, collar, G. H. & R. C. Hollis 619,959
Jar closure, J. H. Fowler 619,950
Knitted fabric, machine for producing striped, P. Hoffman 620,035
Knitting machine, F. C. Rehm 619,840
Knockdown or collapsible box, Johnstone & Lederer 619,757
Lamp for street cars, route indicating, J. A. Lakin 619,965
Lamps, protective device for incandescent electric, R. Kaes 619,829
Latch, gate, J. F. Martin 619,772
Lathe, W. Buckley 619,859
Lemon squeezer, J. W. Neal 620,047
Lens grinding and polishing machine, E. Schadeli 619,793
Leveler and roller, bicycle path or sidewalk, S. P. Hedges 620,034
Limb, artificial, J. Burg 619,716
Linotype machine, P. T. Dodge 619,875
Loom dobbies, indicating device for, G. W. Stafford 619,909
Loom for weaving tufted fabrics, T. W. Head 619,956
Loom shuttle, J. A. Clark 619,720
Loom temple, L. Willemain 620,005
Loom warp stop motion, H. Bardsley 619,856
Lubricator, Kaczander & Ruddy 619,962
Lumber, compound, S. E. Saunders 619,998
Magazine, loading, G. B. Sparrow 619,848
Magazine plate holder, Bullard & Smith 619,860
Malting corn, barley, etc., apparatus for, H. C. Hoefinghoff 619,746
Mattress for invalids, C. J. Angus 619,708
Measuring machine, cloth, J. T. Darby 619,726
Mechanical power, W. T. Venable 619,914
Medicine case, W. F. Barnes 620,013
Metal plate catcher, brander, and polishing machine, J. E. Burson 620,085
Metronome, Becket & Wood 619,857
Mixer for concrete, cement, or other substances, F. B. Gilbreth 620,028
Mouse trap, Hunter & Armstrong 619,754
Mower, lawn, J. Wright 620,067
Music ball, J. Stein 620,087
Music leaf turner, A. G. Lamb 620,043
Music leaf turner, J. S. Webster 619,853
Musical instruments, damper for mechanical, G. Hensch 619,887
Muzzle, animal, J. R. Reynolds 619,994
Nailing machine, H. W. Morgan 619,901
Nut lock, R. E. Cooper 619,722
Nut lock, S. Weibel 619,854
Optometer, F. Hamilton 619,886
Ore concentrating machine, O. Blacket 620,014
Packing box, C. A. Robbins 620,054
Paper rolling machinery, guide flange for, F. Succie 619,803
Pavement, wooden block, J. Buchtel 619,934
Pencil, R. R. Rakestraw 620,051
Permutation lock, C. A. Nash 619,779
Photographer's printing and embossing press, W. A. Billman 619,713
Piano action and touch regulator therefor, F. W. Kringel 619,964
Pick or like tool, W. H. Prest 620,077
Picture frame, J. F. Hathaway 619,743
Pipette, P. Weissgerber 620,066
Planter and cultivator, combined corn and cotton seed, J. H. Forister 619,740
Planter, potato, E. F. Heuer 619,744
Plaster and restainer, manufacture of, H. E. Sturcke 619,911
Pliers for clamping clips on wires, C. C. Baldwin. 619,710
Plow, Arft & Tessin 619,925
Pocket, safety, E. H. Burger 619,861
Pool table, D. A. Fletcher 620,026
Printing machine, cylinder, C. Potter 619,788
Printing press, J. M. Jones 619,828
Propeller, oscillating, C. R. Birkby 619,714
Pulley bearing and lubricator, loose, Yeager & Kastrup 620,068
Pump attachment, mining, B. Chaloner 619,938
Pump, centrifugal, J. Edwards 619,736
Pump curb reservoir, C. A. Bartliff 619,712
Pump, double acting, M. L. Koogler 620,041
Pump operating attachment, E. B. Fetzer 619,824
Puzzle, O. Svanstrom 619,804
Rail joint and forming same, A. C. Heidelberg 620,071
Rail joints, forming, A. C. Heidelberg 620,072
Railway conduit, F. S. Pearson 619,783
Railway coupling, automatic, S. Bandel 619,931
Railway, electric, W. R. & F. S. Woodward 620,009
Railway leveling apparatus, L. Howard 619,751
Railway rails, constructing and bonding electric, S. H. Harrington 620,031
Railway signal system, T. B. Keeler 619,890
Railway switch, automatic street, M. E. Morse 619,980
Reflector for art galleries, G. F. Spencer 619,849
Refrigerating device, ●. Ulrichs 619,808
Rein hold adjuster, McCombs & Parkinson 619,982
Releasing device, animal, W. G. Shafer 619,798
Rotary engine, R. O. Dobbin 619,730
Rotary engine, F. R. Strunk 619,801
Ruling machine, C. Burrows 619,717
Safe, F. S. Holmes 620,073
Safety pin, I. Innes 619,756
Sanitary closet, H. H. Kendrick 620,039
Sash holder and lock, R. M. Chance 619,939
Sash, window, W. W. Newcomb 619,780
Saw gage, rip, F. L. Loetz 619,770
Scale, weighing, H. Valder 620,063
Seat raising device, J. Kirby, Jr 619,894
Sectional boiler for water and steam heating, S. Burns 619,862
Seed drill, R. H. Sleister 620,057
Self-leveling chair for ships, W. M. Knox 619,895
Sewers, water closets, etc., cleaning device for, J. Wrigley 619,920
Sewing apparatus, carpet, E. B. Allen 619,820
Sewing machine corder, J. Douglas 619,877
Sewing machine fan attachment, S. A. B. Burke .. 619,935
Sewing machine shuttle bobbin case, O. H. Rudolph 619,791
Sewing machine trimmer, Diehl & Hemleb 619,873
Sharpener, knife, R. E. Poindexter 620,050
Sharpening scissors, etc., device for, C. A. Dow .. 620,021
Shears tension device, H. A. Sherman 619,999
Shelf, swinging flower, A. E. Hudson 619,752
Shoe or boot stretcher, F. G. Pabst 619,835
Shooting gallery, J. M. Baier 620,011
Shutter fastener, A. L. Stetler 620,058
Shutter operating device, F. F. Williams 620,006
Sifter, flour, M. J. Denison 619,872
Sign, Sentenne & Green 619,797
Singletree, W. P. Murphy 619,904
Skiving machine, counter, W. J. Young 620,010
Soldering machine, tin can, O. Asche 620,083
Sole, lamb's wool shoe, G. W. Gittens 619,742
Spindle and bearing, J. Booth 619,930
Spindle support, J. A. Miller, Jr 619,899
Spray apparatus, J. Morrison 619,903
Spring wheel, G. Townsend 620,061
Stacker, automatic swinging, C. D. Clipfell 619,016
Stamp box, J. W. Cherry 619,716
Stave jointing machine, C. W. Smith 620,000
Steam power system, T. C. Bright 619,715
Steering apparatus, I. W. Cook 619,867
Steering mechanism, J. Lyall 619,972
Stone boat or sled, M. S. Rawson 619,992
Stove attachment, Winner & Martin 619,919
Stove or furnace magazine or retort, A. Bair 619,709
Stoves, composition of matter for blacking and polishing, W. Q. Adams 619,923
Straw elevator, Z. McGonegal 619,983
Switchboard connecting cord circuit, G. K. Thompson 620,002
Syringe, T. F. Moss 619,981
Syringe, W. P. Shattuck 619,845
Tablet holder, Keeler & Barr 619,891
Tablets, machine for applying edge covering strips to, C. H. Crowell 619,870
Tamping and rolling machine, combined, G. A. Mauger 619,977
Tanning hides or skins, S. P. Sadtler 620,056

(Continued on page 143)

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

AMERICAN PATENTS.—AN INTERESTING and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31. 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

PERPETUAL MOTION

A valuable series of papers giving all the classic forms of perpetual motion apparatus. The literature on this subject is so very limited, the only book being entirely out of print, so that this series will be important to all inventors. 30 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **1130, 1131, 1133, 1135, 1136, 1137, 1138.** Price, 10 cents each. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

SENSITIVE LABORATORY BALANCE. By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184.** Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or any bookseller or newsdealer.

THE MACHINERY OF A NAPHTHA Launch.—A detailed description of the motive power of a Modern Naphtha Launch, with sectional views showing all the parts of the boiler and engine. A most valuable paper. 4 illustrations. Contained in SUPPLEMENT **1104.** Price 10 cents. For sale by Munn & Co. and all newsdealers.

CROOKES TUBES AND ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 181, 189, 238, 243, 244, 792, 795, 905, 908, 1050, 1054, 1055, 1056, 1057, also SCIENTIFIC AMERICAN, Nos. 7, 8, 10 and 14, Vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149 and 1150. Price 10 cents each, by mail, from this office, and all newsdealers.

Tap for beer or other kegs, H. Mock 619,978
Telephone, J. T. Gent et al (reissue) 11,719
Telephone apparatus, coin controlled and registering, Cranston & Williams 619,868
Telephone call register, B. Krausse 620,042
Telephone exchange annunciator, W. R. Cole 619,942
Telephone switchboard circuit, T. C. Wales, Jr 620,004
Ticket machine, pin, W. G. Metcalf 619,773
Tire, vehicle, J. J. Czepull 619,871
Tongue cap and line guard, Lockrem & Estwik 619,969
Tooth crowns, apparatus for casting split dies for artificial, J. H. Slinkman 619,847
Towel holder, O. S. Fitzsimons 619,948
Toy, H. T. Kingsbury 619,759
Toy, Kissinger & Matthias 619,762
Toy puzzle, P. Gasparine 619,951
Track sanding device, W. H. Kilbourn 620,040
Traction engine, J. M. Hamilton 620,030
Train order holder and signal, A. McKanna 619,778
Trap. See Fish trap. Gopher trap. Mouse trap.
Trolley, electric railway, E. M. Bentley 619,926
Tube forming apparatus, E. F. Holinger 619,747
Tufting apparatus, cushion, A. Freschl 620,070
Tug, shaft, Colligan & Daley 619,943
Twisting machines, kink preventer and signal for, J. E. Tynan 619,807
Typewriter platen pawl, J. H. Niles 619,985
Typewriting machine, W. J Barron 619,711
Typewriting machine, J. Felbel 619,880
Typewriting machine, J. H. McElroy 619,777
Typewriting machine, M. A. Wier 619,855
Umbrella notch joint, J. H. Fleisch 620,025
Umbrella stick, W. Morrison 619,831
Unicycle, H. G. Wise, Jr 619,816
Upper folding machine, L. T. Adams 619,922
Valve, ball, J. Douglas 619,732
Vehicle spring, W. C. Holland 619,748
Vehicle wheel, H. J. Shawcross 619,846
Velocipede, land and marine, J. C. Young, Jr 619,818
Ventilator. See Car ventilator.
Vise, anvil, L. Stoyer 620,001
Voltaic battery, H. D. Hamilton 619,885
Wagon, dumping, Wuest & Klatt 620,081
Wagon starter, B. J. Sykes 620,059
Wall furring, E. R. Leonard 619,968
Washing machine, T. W. Stone 619,910
Water heating apparatus, M. H. Dorgan 619,876
Water, purifying, J. Wilson 619,917, 619,918
Weighing apparatus, G. U. Merrill 619,898
Welding machine, chain, H. Spuhl 619,850
Wells, tubing or casing joint for artesian and oil, T. J. Bray 619,821
Wheel. See Spring wheel. Vehicle wheel.
Whistle, F. L. Johnson 620,037
Wig foundation, C. C. Cotin 619,823
Winding machine thread oiling device, E. E. Kilbourn 619,893
Windlass, E. M. Carr 619,864
Windlass, W. T. Wood 620,007
Windmill, M. W. Goodrich 619,954
Window frame and sash, C. A. Eighmy 620,023
Wire drawing machine, C. A. Cowles 619,724
Wire, machine for stringing drawing dies upon, C. A. Cowles 619,723
Wire rings and attaching clips thereto, machine for making, A. Calleson 619,937
Wire screen, Hipolito & Mastin 619,958
Wire stretcher, A. A. Coon 620,018
Wire twisting machine, L. W. Noyes 619,782
Wool, cotton, etc., machine for cleaning and carding, J. D. Morel 619,979
Wurtzilite product and apparatus, C. E. Anthony 620,082

DESIGNS.

Bedstead head or foot, J. M. Adams 30,251
Bicycle frame, E. C. Stearns 30,245
Bicycles, etc., fork tube for, W. H. Fauber 30,243
Boiler plate, E. P. Waggoner .... 30,246 to 30,248
Box or like article, ornamental powder, B. G. Taite 30,226
Carpet border, J. Spring 30,257
Chain link, J. Smith 30,242
Cord tip coupling, flexible, J. B. Hardy 30,255
Corkscrew handle, W. R. Clough 30,234
Counterbalance spring casing, J. M. Gagan 30,238
Cream separator, J. E. Phillips 30,244
Fabric, A. Bierman 30,258
Garment hanger, F. Sager 30,231
Hair drier, H. E. Bingham 30,229
Hammock back, W. A. Green 30,256
Hook, trouser, A. J. Shipley 30,232
Lamp body, F. Rhind 30,249
Lamp chimney, W. Buttler 30,250
Lever, A. A. Longman 30,239
Massage tool, M. E. Barnet 30,230
Match safe or tray, B. Wolf 30,228
Nut cracker base, A. Baumgarten 30,227
Pattern, coat, F. W. Beberdick 30,259
Pliers, member for pair of, L. P. Smith 30,237
Pouring guide, L. Melcher 30,235
Punch die or cutter, O. Sohni 30,236
Scraper, cotton, Z. N. T. Milirons 30,241
Sewing card perforators, frame for, J. R, Orwig 30,240
Stair corner guard, F. D. Goodwin 30,252
Tag, J. C. Wells 30,254
Thermometer case, J. B. Gabe 30,225
Trousers fastening bar, A. J. Shipley 30,233
Type, font of, J. W. Phinney 30,253

TRADE MARKS.

Antiseptic and germicidal compound, R. & F. Schweickhardt 32,518
Bales of cotton and other fibrous goods, Planters Compress Company 32,509
Chemical substances, certain named, Actien Gesellschaft fur Anilin Fabrikation .... 32,529 to 32,532
Coffee, Hygienic Specialty Company 32,517
Firearms, Colt's Patent Fire Arms Manufacturing Company 32,536
Grease for lubricating purposes, Snowdon Sons & Company 32,533
Groceries, certain named, Charles & Company 32,514
Hair and scalp tonics, A. F. Richardson 32,622, 32,523
Hats and caps, men's and boys', Boogher, Force & Goodbar Hat Company 32,510
Knit goods or underwear, Hay & Todd Manufacturing Company 32,511
Lamps, bicycle and carriage, Calcium King Lamp Company 32,535
Medical compound, certain named, J. G. Baker 32,520
Medicinal remedies, certain named, E. L. Andrews 32,521
Medicines and toilet preparations, proprietary, L. H. Wells 32,524
Oil, illuminating, Union Chemical Company 32,634
Paints, certain named, A. A. Eberson 32,513
Remedy for seasickness and car sickness, L. H. Hammond 32,519
Rubber boots and shoes, C. W. Linthicum 32,512
Soap, Montgomery & McGrigory 32,527
Soap and soap powders, J. Tulloch 32,528
Soap, laundry, toilet, and scouring, F. Acker & Company 32,526
Starch, laundry, W. P. Clotworthy 32,515
Tea, package, Oakford & Fahnestock 32,516
Toilet preparations, certain named, M. C. Whelan 32,525

PRINTS.

"Alone on the Summit," for glazed kid leather, American Leather Company 108

LABELS.

"Armstrong's Furniture Polish," for a furniture polish, Armstrong Furniture Polish Company 6,829
"Dare's Elixir Mentha Pepsin," for a remedy for certain named diseases, C. F. Dare & Son 6,827, 6,828
"Dutch Java Blend Coffee," for coffee, Dayton Spice Mills Company 6,824
"Fill the Basket," for egg food, J. W. Barwell 6,823
"Mellin's Food for Infants and Invalids," for food for infants and invalids, Mellin's Food Company 6,820
Mellin's Infants' Food," for food for infants and invalids, Mellin's Food Company 6,821, 6,822
"Peirce's Golden Rio Coffee," for coffee, O. H. Peirce & Company 6,825
"Uncle Sam's Button Shine," for a cleaning and polishing preparation, R. F. Bradbury 6,930
"Wurtzberger Malt Extract," for malt extract, W. E. Beckham 6,826

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

PROPOSALS.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Light-House Engineer, Baltimore, Md., until 12 o'clock M., March 15, 1899, and then opened, for furnishing the material and labor of all kinds necessary for the erection and delivery of the Hooper Island Light-House, Md., in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to W. A. JONES, Lieut.-Colonel, U. S. A.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Light-House Engineer, Baltimore, Md., until 12 o'clock M., March 15, 1899, and then opened, for furnishing the material and labor of all kinds necessary for the completion and delivery of the metal work for Hooper Island Light-House, Md., in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to W. A. JONES, Lieut.-Colonel, U. S. A.